Annex

Governance of protected areas in West Africa

The case of the W-Arly-Pendjari (WAP) Complex
in Benin and Burkina Faso

List of tables

* A= Annex

List of figures

* A= Annex

Abbreviations & Acronyms

A	AA	*Action Arena*
	ACRAP	*Association des Communes Riveraines aux Aires Protégées du Parc W*
	ADAP	*Association pour le Développement des Aires protégées*
	AFD	*Agence Française de Développement*
	AGEREF	*Association intervillageoise de gestion des ressources naturelles et de la faune*
	AVC	*Association Villageoises de Chasse*
	AVIGREF	*Association Villageoise de Gestion des Réserves de Faune*
B	Be	*Benin*

	BF	*Burkina Faso*
	BZ	*Buffer Zone*
C	CA	*Chef d'Arrondissement*
	CARDER	*Centre d'Action régionale pour le développement rural*
	CAV	*Cellule Action Villageoise*
	CBD	*Convention on Biodiversity*
	CC	*Comités de Concertation*
	CENAGREF	*Centre National de Gestion des Réserves de Faune*
	CFA	*Franc de la Communauté Financière d'Afrique*
	CGF	*Commissions de Gestion de la Faune*
	CIESIN	*Center for International Earth Science Information Network*
	CONEDD	*Conseil National pour l'Environnement et le Développement Durable*
	COP	*Conference of the Parties*
	CPR	*Common-pool ressource*
	cv	*oefficient of variation*
	CVD	*Commission Villageoise de Développement*
	CVGF	*Comités villageois de Gestion de la Faune*
	CVGT	*Commission Villageoise de Gestion de Terroir*
D	DESA	*Department of Economic and Social Affais, United Nations*
	df	*Degrees of freedeom*
	DFC	*Direction de la Faune et de la Chasse*
	DGCN	*Direction Générale de la Conservation de la Nature*
	DGFRN	*Direction Générale des Forêts et des Ressources Naturelles*
	DNCPF	*Direction Nationale du Cadre Paramilitaire des Eaux et Fôrets*
	DP	*Directeur Provincial*
	DPECV	*Direction Provinciale de l'Environnement et du Cadre de Vie*
	DPNP	*Direction du Parc National de la Pendjari*
	DPNW	*Direction du Parc National du W*
	DRECV	*Direction Régionale de l'Environnement et du Cadre de Vie*
E	ECOPAS	*Ecosystèmes Protégés en Afrique Soudano-Sahélienne*
	ECOWAS	*Economic Community Of West African States*
	ESA	*European Space Agency*
	EU	*European Union*
F	FAO	*Food and Agriculture Organization of the United Nations*
	FIC	*Fonds d'Interet Collectif*
G	GA	*General Assembly*
	GC	*GLOBCOVER*
	GDP	*Gross Domestic Product*
	GEF	*Global Environmental Facility*
	GIS	*Global Information System*
	giz, gtz	*Gesellschaft für internationale Zusammenarbeit, formerly known as Gesellschaft für technische Zusammenarbeit*
	GLC	*Global Land Cover*
H	H	*Hypothesis*
	HDI	*Human Development Index*
	hh	*household*
I	IAD	*Institutional Analysis and Development Framework*

	ICDP	*Integrated Conservation and Development Projects*
	IDA	*International Development Association*
	IUCN	*International Union for the Conservation of Nature*
J	JRC	*Joint Research Center*
K	KfW	*Kreditanstalt für Wiederaufbau*
M	MAB	*Man and the Biosphere*
	MAEP	*Ministère de l'Agriculture, de l'Elevage et de la Pêche*
	M&E	*Monitoring & Evaluation*
	MEA	*Millennium Ecosystem Assessment*
	MECV	*Ministère de l'Environnement et du Cadre de Vie*
	MEPN	*Ministère de l'Environement et de la Protection de la Nature*
	METT	*Management Effectiveness Tracking Tool*
	MDG	*Millennium Development Goal*
	MDR	*Ministère du Developpement Rural*
	MIKE	*Monitoring the Illegal Killing of Elephants*
	MODIS	*Moderate-resolution Imaging Spectroradiometer*
N	n.a.	*not applicable*
	NGO	*Non-governmental Organisation*
	NP	*National Park*
O	OECD	*Organisation for Economic Co-operation and Development*
	OFINAP	*Office National des Aires Protégées*
P	PA	*Protected Area*
	PAGEN	*Projet de Partenariat pour l'Améloration de la Gestion des Ecosystèmes Naturels au Burkina Faso*
	PAPACO	*Programme Aires Protégées pour l'Afrique du Centre et de l'Ouest*
	PAUCOF	*Projet d'Appui aux Unités de Conservation de la Faune*
	PCGPN	*Programme de Conservation et de Gestion des Parcs Nationaux*
	PDC	*Plan de Développement Communal*
	PES	*Payments for ecosystem services*
	PGRN	*Projet de Gestion des Ressources Naturelles*
	PN	*Parc National*
	ProCGRN	*Programme de Conservation et de Gestion Durable des Ressources Naturelles*
R	RAPPAM	*Rappid Assessment and Prioritization of Protected Area Management*
	RBP	*Réserve de Biosphère de la Pendjari*
	REVICA	*Réserve Villageoise de Chasse Autogérée*
S	SE	*Secrétariat Exécutif*
	SES	*Socio-Ecological-System*
	SD	*Standard Deviation*
	SLOSS	*Single Large Or Several Small*
	SP-CNCPDR	*Secrétariat Permanent du Cadre National de Concertation des Partenaires du Developpement Rural Décentralisé*
T	TNC	*The Nature Conservancy*
	TWB	*The World Bank*
U	U	*Union*
	UICN	*Union Internationale pour la Conservation de la Nature*
	UN	*United Nations*

	UNCED	*United Nations Conference on Environment and Development*
	UNDP	*United Nations Development Programme*
	UNEP-WCMC	*United Nations Environmental Programme - World Conservation Monitoring Centre*
	UNESCO	*United Nations Educational, Scientific and Cultural Organization*
	UNFCCC	*United Nations Convention on Climate Change*
	UPC	*Unité de Protection et Conservation*
	USA	*United States of America*
V	Vpb	*Village participatory body*
W	WAP	*W-Arly-Pendjari*
	WB	*World Bank*
	WCPA	*World Commission on Protected Areas*
	WWF	*World Wide Fund for Nature*
Z	ZEC	*Zone d'Exploitation Contrôlée*
	ZOC	*Zone d'occupation controlee*
	ZOVIC	*Zones villageoises d'intérêt cynégétique*

List of Annexes (texts only)

Chapter 1

Tab. 1.2: The IUCN framework categories for PA management

IUCN Protected Area Management Categories

Ia Strict Nature Reserve	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring
Ib Wilderness Area	Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
II National Park	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
III Natural Monument or Feature	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.
IV Habitat/Species Management Area	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category
V Protected Landscape/ Seascape	A protected area where the interaction of people and nature over time has produced an area of distinct charcter with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other value
VI Protected area with sustainable use of natural resources	Category VI protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area

http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/

Annex 1.1: Evaluation

Given these quite sobering findings in combination with the great variety and omnipresence of exploitation pressures on natural resources and ecosystems on the one hand, and limited human and financial resources on the other hand, funding and implementation of conservation activities have to be based on the principles of efficiency, effectiveness (Sheil 2001) and prioritization (Brooks et al. 2006b). With regard to the actual status of PA governance and management, it is therefore mandatory to critically assess the relative value of all intervening activities, supported by well planned monitoring and evaluation schemes (Hockings 2000; Sheil 2001; Ervin 2003; Ferraro & Pattanayak 2006). However, in spite of a high volume of scientific research how to identify hotspots and maintain a maximum of biodiversity in PAs (e.g. Whittaker et al. 2005; Turner & Wilcove 2006), there is a gap in conservation implementation (Knight et al. 2009) as solutions in practice are usually compromised by the diversity of realities based on economic and political interests (Margules & Pressey 2000). This also holds true (especially for long-term science-based) monitoring and evaluation activities: they are regularly skipped due to tight financial budgets.

Evaluating the overall effectiveness of PAs and PA networks obviously strongly depends on their specific purpose and targets as well as the variables studied, either focusing on environmental, social or economic aspects. Effectiveness hence may either relate to the question of PA coverage and representativeness or rather to management processes and their outcomes. IUCN-WCPA correspondingly differentiates three main themes of PA management effectiveness: (1) design issues relating to both individual sites and PA systems; (2) adequacy and appropriateness of management systems and processes; (3) delivery of PA objectives including conservation of values (Hockings et al, 2006), i.e. ecological integrity (Ervin 2003).

- **Management Effectiveness**

Very few authors still question the PA approach in general, considering both their ecological success as well as their potential to deliver social and socio-economic benefits. Their ability to fulfill their primary purpose – the protection of natural assets –

has principally been proven (e.g. Bruner et al. 2001, Struhsaker et al. 2005, Clerici et al. 2007; Nagendra 2008), even if this does not mean they are doing well in all cases worldwide (Ervin 2003; WWF 2004). On the contrary, there is growing concern that many are mere paper parks, insufficiently if at all managed (Carey et al. 2000). Leverington et al. (2010a) found on a large scale study of 4000 PAs worldwide that 40% of PAs showed major management deficiencies. Overall, the arguments of PA critics mainly concentrate on moral and legal aspects of excluding and displacing people from parks (Neumann 1997, Lele et al. 2010), and a general lack of management effectiveness not able to stop threats or introduce alternative ways of valuation. While some nevertheless see the future development of PAs as major conservation tool bright (at least for the establishment of new PAs) (McDonald & Boucher 2011), others emphasize that the effectiveness of existing and the current pace of the establishment of new PAs will fail to overcome current trends of biodiversity loss (Mora & Sale 2011).

As recognition among conservation practitioners, donors and scholars is growing that good, adaptive project management and enhanced accountability are integrally linked to well-designed and implemented monitoring and evaluation (M&E) systems (Stem et al. 2005), a growing number of assessment tools for management effectiveness have been developed in recent years (Hockings 2003) (see **Tab. 1.3**). Spurred inter alia by the *Programme of Work on Protected Areas* (drawn up by the Convention on Biological Diversity in 2004 and requesting countries to carry out management effectiveness assessments of at least 30% of their protected areas (Dudley et al. 2005) by 2010) several thousands of such effectiveness assessments have been carried out since the 1990ies (Leverington 2010a). However, the initial aim of covering 30% proved to be overambitious and had not been reached (Stoll-Kleemann 2010). The issue though remains topical.

Tab. 1.3: Selection of PA management effectiveness assessment tools. RAPPAM and METT are used most frequently (until 2010 ca. 2000 times; Leverington et al. 2010)

Evaluation tool	Characteristics	Created by
Rappid Assessment and Prioritization of Protected Area Management (RAPPAM)	Quick assessment of strengths and weaknesses for whole PA systems; currently the tool used most often	WWF

Management Effectiveness Tracking Tool (METT)	Quick assessment of strengths and weaknesses for single PAs	The World Bank/ WWF Alliance for Forest Conservation and Sustainable Use
Measures of success	Focuses on threat status and ecological integrity; translates complex ecological indicators into simple categories	The Nature Conservancy (TNC)
Enhancing our Heritage	Tool-box of twelve items for the evaluation of UNESCO World Heritage Sites; going more to detail	UNESCO/IUCN
Monitoring Important Bird Areas	Focuses on monitoring of bird populations; integrates information assembled by experts and amateurs	Bird Life International

Stoll-Kleemann 2010, Leverington et al. 2008; Getzner et al. 2012; Parrish et al. 2003; Leverington et al. 2008 present a compilation of the most important assessment tools used worldwide

Today there is a great variety of different evaluation tools, however, those being used most often relate to the framework developed by the IUCN-World Commission on Protected Areas (WCPA) (Leverington 2010b, Stoll-Kleemann 2010). The core of this framework is a project cycle consisting of six elements, each of which is addressed by specific indicators. These elements are: context, planning, inputs, processes, outputs and outcomes (Hockings et al. 2000). As they are complementary, an assessment ideally addresses all of them. Hockings (2003) identified two types of data used in most evaluation tools: quantitative data derived from monitoring and qualitative data derived by scoring of managers and other stakeholders in rapid assessments. In his review of 27 methodologies only two contained both, monitoring and scoring data. ("The measures of success" framework of The Nature Conservancy is an example of such an approach (Parrish et al. 1998)). The largest group, however, relied exclusively on scoring data, and, though appraisals are often conducted as participative stakeholder processes, subjective perception of respondents and individual knowledgebase remain the primary source of information. Results often mirror field-experience and can provide valuable insights of practical utility especially in the absence of investment-intensive monitoring schemes, however, should be supplemented by scientific quantitative data

on ecological, social, socio-economic and political key features wherever possible (Stem et al. 2005).

Generally, results of evaluations deliver a rather mixed picture of PA performance for all dimensions, depending i.a. on regional focus and spatial scale of the assessment (e.g. Barber et al. 2012). Especially on the local level a large scope of PA features and management outcomes have been reported. Deriving conclusions on the macro-level from these case studies, based on high internal variance and affected by diverse PA characteristics and contexts, has therefore to be made with caution. Furthermore, despite some dominating frameworks, there is no consistent methodology of data acquisition and evaluation across PA management projects in place and the overall set of rigorous studies is rather limited (Miteva et al. 2012). Besides providing necessary feedback-loops to those projects being assessed, individual assessments feed their findings into large-scale meta-studies that often concentrate on the identification of success factors enhancing the probability of positive outcomes. Some major findings of different kinds of assessments are displayed in **Tab. 1.1**. Many of these factors refer to material inputs as well as actual rule settings and the interaction among stakeholders, i.e. to issues of PA governance. These are treated in detail in Chapter 2.

▪ **Ecological performance**

Coverage, representativeness & design issues

Despite growing numbers of PAs, the above mentioned 2010 target (10% of each biome protected) was missed for half of terrestrial and all marine ecoregions and biodiversity erosion continues (Jenkins & Joppa 2009; Stokstad 2010). Even though more than 10% of the terrestrial surface was protected, PAs were distributed unevenly among regions. In 2009 six of fourteen terrestrial biomes were below the target level (Jenkins & Joppa 2009). Richer countries, often less rich in biodiversity, tend to protect more land in general and as strict PAs in particular, indicating that land protection might be seen as an economic amenity (MacDonald & Boucher 2011). Moreover, there seems to be a selection bias in sites within biomes, which means that sites that are less accessible and less subject of economic or agricultural interest are likely to be selected to become PAs (Margules & Pressey 2000; Naughton-Treves et al. 2005; Lele et al. 2010) The

same pattern is reflected on the sub-national level. Furthermore, Leroux et al. (2010) found that PAs with sustainable use of natural resources are relatively low in disturbance, whereas strict nature reserves showed to be highly impacted by human footprint. PAs of the first category proved to be generally larger than those of the other categories (Leroux et al. 2010). Measuring just extent of PA coverage is therefore not a suitable indicator of measuring the success of preserving intact biodiversity.

Generally, one of the greatest challenges in the context of coverage is to choose surrogates that help to handle the complexity of natural systems and that can be used as indicators for overall biodiversity (Margules & Pressey 2000) so to chose and protect the most valuable (in terms of biodiversity) places. There is not necessarily congruence between biodiversity hotspots of different taxa (Burgess et al. 2006), e.g. between vertebrates and plants (Ricketts et al. 1999) and endemism does not automatically include high level of biodiversity. In terms of species representation the global PA system proved to be incomplete (Rodriguez 2004). Instead of focussing on species, higher levels of biodiversity can be used to integrate ecological processes that assure ecosystem functions and services (Margules & Pressey 2000; Burgess et al. 2006). Scientific gap analysis of PA systems based on complex selection algorithms indicating e.g. complementary of biodiversity assets, and resulting prioritisation schemes for new PAs to be declared (e.g. Whittaker et al. 2005, Turner & Wilcove 2006) indeed found their way into practical application and environmental politics. Besides biodiversity, another variable concerning PA coverage that gained growing attention in recent years is their service of keeping great stocks of carbon. Tropical forests and northern latitude soils and peatlands are identified as carbon hot spots (Gibbs et al. 2007). Hence, by overlying maps designating high biodiversity areas with those designating high carbon stocks, multiple benefit areas can be identified and used to complement the global PA system (Strassburg et al. 2010).

Design issues of PAs, respectively PA networks have long been centred on a debate called SLOSS (Single Large Or Several Small) in conservation science literature (Diamond 1975, Ovaskainen 2002). Based on assumptions of bio-geographical theory and meta-population dynamics, it was discussed whether it was better to preserve individual large areas that suffer less from edge effects and offer large continuous habitat to potential high number of species, rather than protecting a multitude of smaller

areas that offer a variety of different habitats and enable migration and exchange between them. Solutions for implementation, however, are dependant on the ecological context of PA establishment. Even if very large PAs have high potential for protecting ecosystem services at the landscape level and guarantee persistence of large populations, those very large PAs existing today are highly biased in environmental coverage, contain low numbers of overall and threatened species, and make only limited contributions toward meeting global conservation prioritization schemes (Cantú-Salazar & Gaston 2010). General recommendations are therefore that PA boundaries should acknowledge the landscape context (e.g. watersheds), that large areas should be favoured over small reserves, that edge effects should be minimised by avoiding linear shapes and minimising boundary-area rations, and that PAs should be linked by corridors wherever possible (Bakarr & Lockwood; Lockwood et al. 2006).

On their quest to find answers to the question of what and where to protect, several internationally operating conservation NGOs defined key areas of high conservation importance in order to bundle project activities – including establishment of PAs- to these priority eco-regions (Worboys & Winkler 2006). They are usually of unique and/or outstanding biodiversity values, i.e. high irreplaceability, and/or under high human exploitation pressure, i.e high vulnerability (Brooks et al. 2006). WWF e.g. defined its "Global 200" terrestrial, freshwater and marine ecoregions with distinct assemblages of natural communities (Olson & Dinerstein 2002), whereas Conservation International identified "Biodiversity Hotspots" characterized by high biodiversity (1500 species of vascular plants) and at least 70% of its original habitat already lost (Myers et al. 2000).

Ecological integrity

Measuring ecological integrity within PAs is a difficult task. According to Parrish et al. (2003), "we define ecological integrity as the ability of an ecological system to support and maintain a community of organisms that has species composition, diversity, and functional organization comparable to those of natural habitats within a region. An ecological system or species has integrity or is viable when its dominant ecological characteristics (e.g., elements of composition, structure, function, and ecological processes) occur within their natural ranges of variation and can withstand and recover

from most perturbations imposed by natural environmental dynamics or human disruptions."

Most PAs are smaller than 10.000 ha (Naughton-Treves et al. 2005), might not cover the area necessary to ensure key ecological processes such as sustainable water or nutrient cycling (Pringle 2001), provide sufficient habitat for the persistence of viable population sizes and migration routes (Newmark 2008), or withstand edge effects (Harper et al. 2005) in the long term. PAs have to be regarded as open rather than closed systems, being threatened by expanding and intensifying of human land use in the areas surrounding them (Hansen & DeFries 2007). This process of increasing human population growth around PAs (Wittemeyer et al. 2008) and resulting isolation of PAs has often been reported (Joppa et al. 2008, Newmark 2008, Clerici 2007, DeFries et al. 2005). Several authors therefore stress the importance of integrating PAs into regional planning (Margules & Pressey 2000; Hansen & DeFries 2007) and larger PA systems (CBD 2005). Though being debated, the establishment of buffer zones surrounding PAs has been adopted as another core strategy for embedding PAs into their surroundings (Neumann 1997, Martino 2001, Hansen & DeFries 2007) and reducing edge effects. By integrating not only landscapes with strong socio-economic, but also hydrological and ecological interactions between PAs and their surroundings, these zones of interaction can become several times larger than the PAs itself (DeFries et al. 2010).

Surrogates for relative ecological integrity, resp. biodiversity, have to be chosen for practical conservation application. Often these are associated with threat and threat status of key resources, and therefore directly linked to specific management interventions (Parrish et al. 2003, Ervin 2003). Ideally, there are detailed monitoring schemes in place that regularly report on conditions and trends of these key indicators, like population dynamics of key species or forest conditions (Leverington et al. 2010a) on a scientific basis. However, costs associated with such monitoring schemes are high and require some level of scientific background to be set-up and to interpret their results (Parrish et al. 2003). Often they are not incorporated into management practice and therefore do not support feedback loops necessary for adaptive management (Leverington et al. 2010a). Generally, there is a lack in sound scientific monitoring data, especially for long-term time series. There are also few studies that compare

characteristics of biodiversity within and outside individual PAs or PA systems, respectively the evolution of specific target species/ assemblages within PAs after establishment to evaluate PA effectiveness (Gaston et al. 2008). Moreover, results have been as diverse as PA settings are, with some studies revealing greater richness/ abundance inside PAs, no difference or even higher values outside PAs, respectively a decline or also an increase in abundance of species after establishment of PAs (Gaston et al. 2008).

New remote techniques can help to analyse land cover change in PAs and their surroundings, either for single PAs, PA systems or even on the global scale. As non-forest environments like savannahs are more difficult to survey, most often forest systems are used as reference (Leverington et al. 2010). Changes of extent and quality can easily be assessed for large and distant areas (Nagendra 2008), often for a relatively long period of time, and be correlated to management practice. Another reason for focusing in particular on tropical forests is their extraordinary share of global biodiversity (estimated to be +50%) and the fact that forest products, foremost wood, represent important commodities of high value that can easily be transformed into financial capital (and hence has been in the focus of natural resource management for a long time). Comparing vegetation cover (e.g. Joppa et al. 2008), respectively rates of change of forest cover (e.g. Nagendra 2008) inside and outside protected areas (spatial scale) or after initiation of protection (temporal scale), or other proxies for effective protection like reduced fire frequency (e.g. Worldbank 2009), these studies generally found PAs to be an effective tool in protecting tropical forests with respect to land cover clearing. Nagendra (2008) e.g. found in a study of 49 locations from 22 countries that rates of clearing were significantly lower inside PAs than in their surroundings, and that PAs had significantly lower rates of clearing within their boundary following PA establishment. However, regional differences remain.

Obviously, these studies are unable to make any conclusions on other impacts on the system than land clearing. Poaching of large fauna e.g. remains undetected as its ecological consequences on forest structure and survival will become apparent only in larger time spans. As ecological processes like this, potentially in combination with those induced by direct habitat loss and fragmentation, often take time to manifest in system change, some authors labeled such phenomena as "extinction debt" within PAs

(Hanski & Ovaskainen 2002). High poaching pressure leading to significant reductions in population sizes and consequently to system change was described as empty forest syndrome by Redford (1992), and infects PAs as well as non-PAs (Oates 1999). Indeed poaching is one major threat to PAs worldwide (Ervin 2003). A multitude of studies thus documented population declines or extinctions inside PAs for various taxonomic groups and even target species of management action (Brashares et al. 2001, Woodroffe & Ginsberg 1998, Dinerstein et al. 2007, Thiollay 2006, Caro & Scholte 2007; Fischer & Linsenmair 2007), with human impact playing at least some role in decreasing population sizes. Even on a continent-wide scale and a time frame exceeding 30 years, severe declines of large mammals in African PAs have been documented (Craigie et al. 2010) and question the overall and long term effectiveness of these PAs.

Novel challenges for PAs emerge from the consequences of climate change. As these sites are fixed in space and time (Wiens et al. 2011), altering climatic conditions will induce change in habitat conditions and community compositions. Although responses of individual species to environmental change vary, their primary reaction to large-scale and quick climatic changes is migration and the shift of their geographical distribution (Hole et al. 2011). Such changes are already occurring (Parmesan & Yohe 2003) and deprive some species/ populations of suitable habitat and protection, whereas others might profit and move into the altered habitat (Hole et al. 2009). Higher dynamic of species ranges and overall turnover (Hannah 2007) will hence require adaptation in PA strategies, including the establishment of new sites and stronger linkage among existing ones.

Chapter 2

Spatial	**Temporal**	**Jurisdictional**	**Institutional**
Areas	*Rates, Durations, and Frequencies*	*Administrations*	*Rules*

Globe — Regions — Landscapes — Patches

Annual — Seasonal — Daily

Inter-governmental — National — Provincial — Localities

Constitutions — Collective choice rules — Operating rules
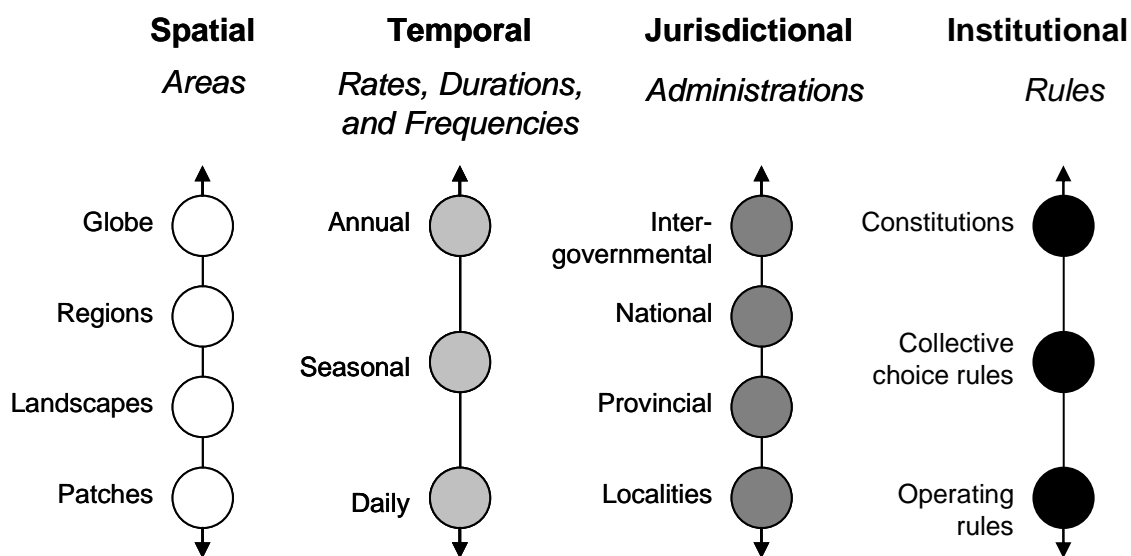
Fig. 2.5: Illustration of different scales and levels that play a role in analysing SESs. Presented scales are spatial, temporal, jurisdictional and institutional dimensions, with levels located at different positions on each scale. Interactions can occur between levels within one scale, but also across scales (e.g. Provincial administrations might be in charge to implement constitutional rules of national governments at the landscape and patch level; ecological boundaries often do not correspond to administrative units and hence require cooperation among organisations); adopted from Cash et al. (2006)
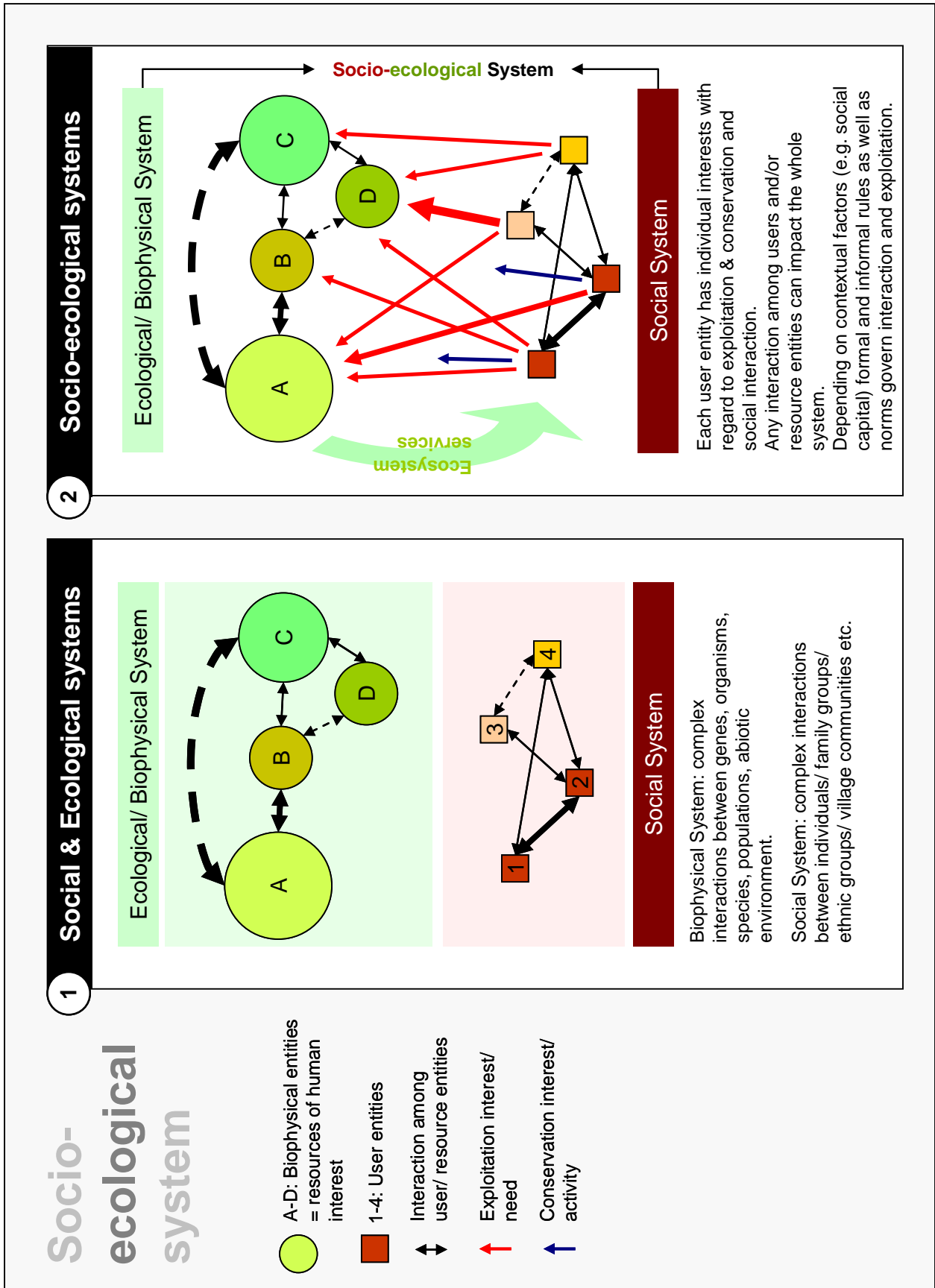
Fig. 2.6.1 & 2: The concepts of social, ecological and socio-economic systems
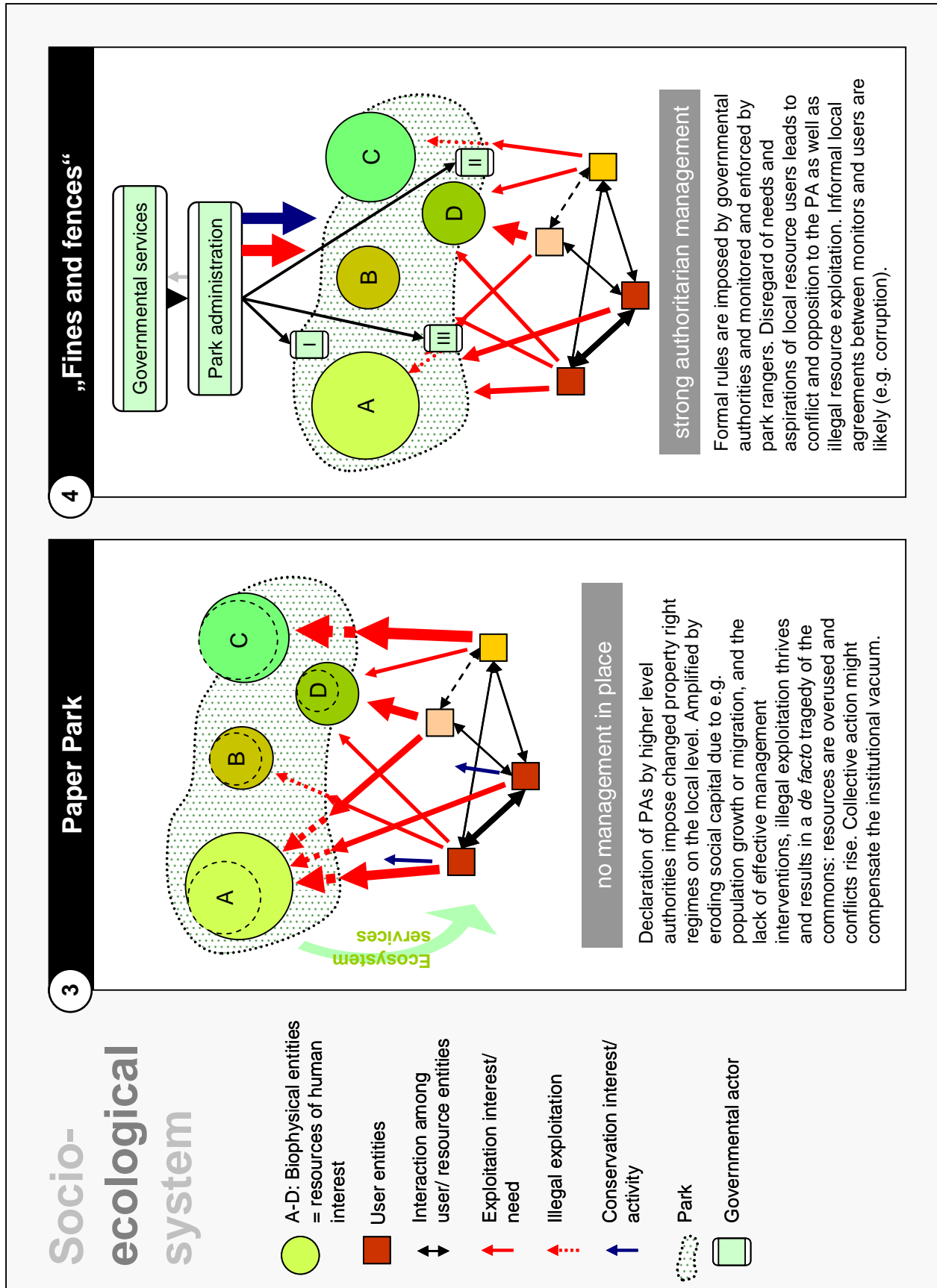
Fig. 2.7.1 & 2: Conceptual map of PAs without any rule enforcement (paper parks) and strict authorative approaches that restrict and sanction resource exploitation.
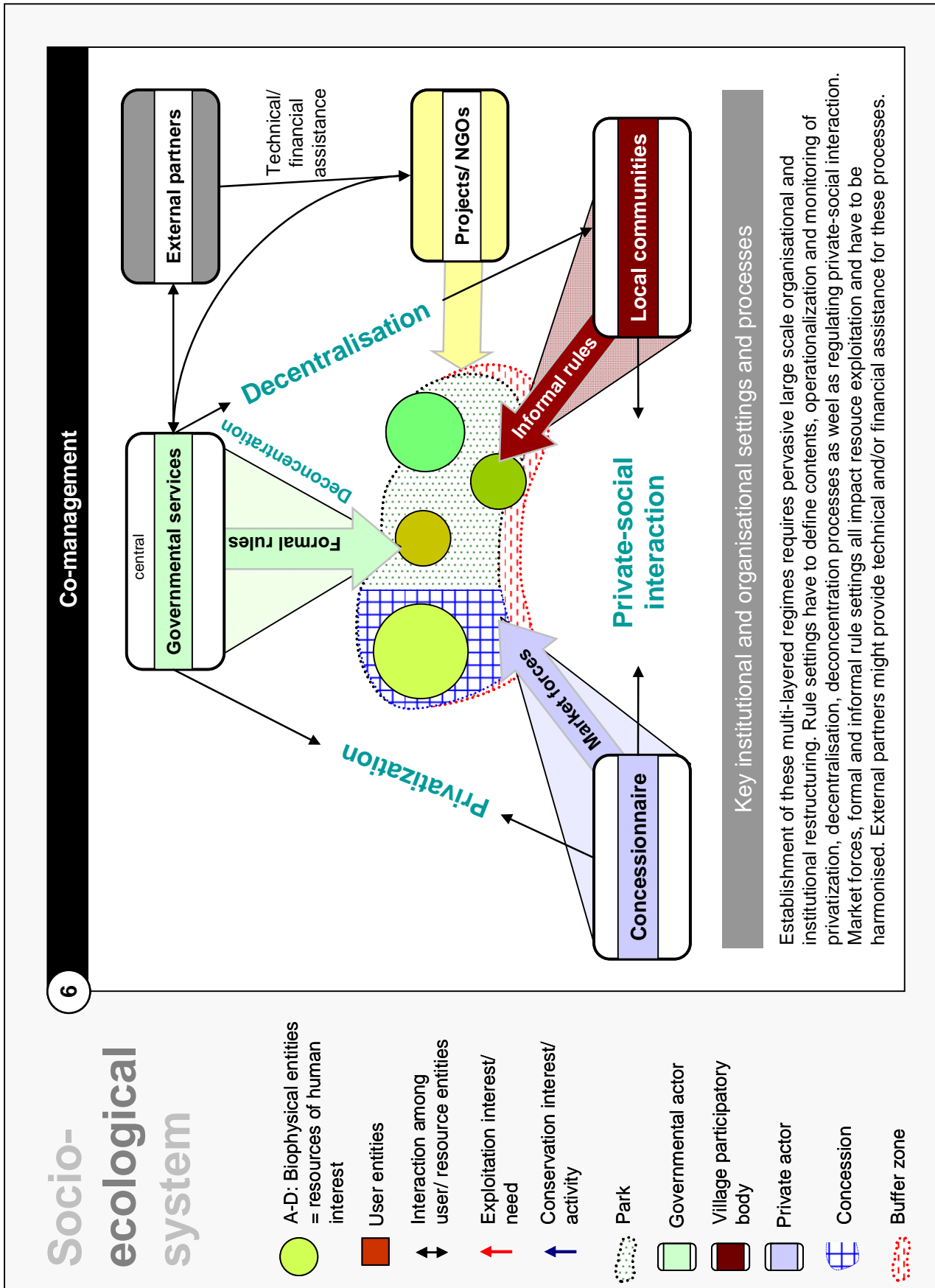
Fig. 2.8: Key institutional and organisational settings and processes associated with co-management arrangements

Tab. 2.2: Array of property rights. Positions of higher levels (lower part of table) usually also possess property rights of lower levels (upper part of table); e.g. an authorized user also has the right to enter the physical area of the resource.

Property right	Definition	Position of beneficiary
Access	The right to enter a defined physical area and enjoy non-subtractive benefits (e.g. hiking, canoeing)	Authorized entrant
Withdrawal	The right to obtain resource units or products of a resource system (e.g. cutting fire wood or timber, harvesting mushrooms, diverting water)	Authorized user
Management	The right to regulate internal use patterns and transform the resource by making improvements	Authorized claimant
Exclusion	The right to determine who will have an access right, and how that right may be transferred	Proprietor
Alienation	The right to sell or lease management and exclusion rights	Owner

From: Agrawal & Ostrom 1999, based on Schlager & Ostrom 1992

Tab 2.3: UNDP principles of good governance

Principle	Explanation
Participation	Everybody has a voice in decision-making, either directly or through legitimated intermediaries
Rule of law	Fair and enforced legal frameworks guide interaction
Transparency	A free flow of information on processes, institutions and organisations is guaranteed
Responsiveness	Authorities try to serve all stakeholders
Consensus orientation	Mediation of differing interests to reach a consensus what is best for the group concerned
Equity	Everybody has the same opportunities to improve or maintain his/her well-being
Effectiveness and efficiency	Processes and institutions produce results that meet needs while making the best use of resources
Accountability	Decision-makers in government, the private sector and civil society organisations are accountable to the public, as well as to institutional stakeholders. This accountability differs depending on the organisation and whether the decision is internal or external to an organisation.
Strategic vision	Based on the understanding of the historical, cultural and social contexts, leaders and the public have a broad and long-term perspective on good governance and human development

From: UNDP 1997. Governance for sustainable human development. UNDP Policy Document.

A **Constitutional**

AA (1)

AA (2)

AA (A)

AA (3)

AA (A): different governmental services adopt a new law that regulates financial participation of local communities

AA (1): international consultations lead to the adoption of binding agreements, e.g. the CBD

AA (2): the government and civil society conceptualize the framework for the establishment of local governments

AA (3): ministry of tourism estabishes a new strategic plan to promote tourism (as source of income for PAs)

B **Collective choice**

AA (4)

AA (B)

AA (5)

AA (B): deconcentrated services, community delgates and project staff agree on a performance based alllocation scheme for PA village participatory bodies

AA (4): the financial planning of the commune calculates with stable income from PA

AA (5): a local association for women rights lobbies for their interests and demands the establishemnt of well equipped maternity units in the villages

C **operational**

AA (C)

AA (6)

AA (7)

AA (C): after evaluating the performance of vpbs, their union organises a ceremony and distributes respective shares to villages

AA (6): Village I follows the recommendations of the collective choice level authorities and constructs a maternity unit

AA (7): In village II all income is embezzled by the president of the vpb, causing conflict and dissatisfaction with PA rules

Fig. 2.9: A simplified network of action arenas (AA). Main arenas are labelled with letters A-C, side arenas with numbers. The network shows the implementation process of local communities' financial participation in PA benefits

Key action arenas are labelled with letters A-C, while side arenas of differing importance are labelled with numbers. The process mapped here is the financial participation of local communities living adjacent to a PA. Stimulated by international input (AA (1)), e.g the programme of work for PAs of the CBD, national legislature formulates a legal framework for financial participation (AA (A)) on the constitutional level that is directly

impacted by other national deconcentration and decentralization processes (AA (2)) as well as economic strategies adopted by other governmental authorities (AA (3)). On regional or local level, respective stakeholders include deconcentrated and decentralised authorities as well as communities and other representatives of the civil society (AA (B)). They decide in collective choice arenas according to which indicators benefits are distributed to village participatory bodies in the PA vicinity. Other potential recipients (AA (4) & (5)) might also lobby for their interests and so influence the outcomes of AA (B). Finally, payments are handed over to vpbs in the villages by the union of all vpbs (AA (C)) and then invested in village infrastructure (or also misused for some other purpose).

Chapter 3
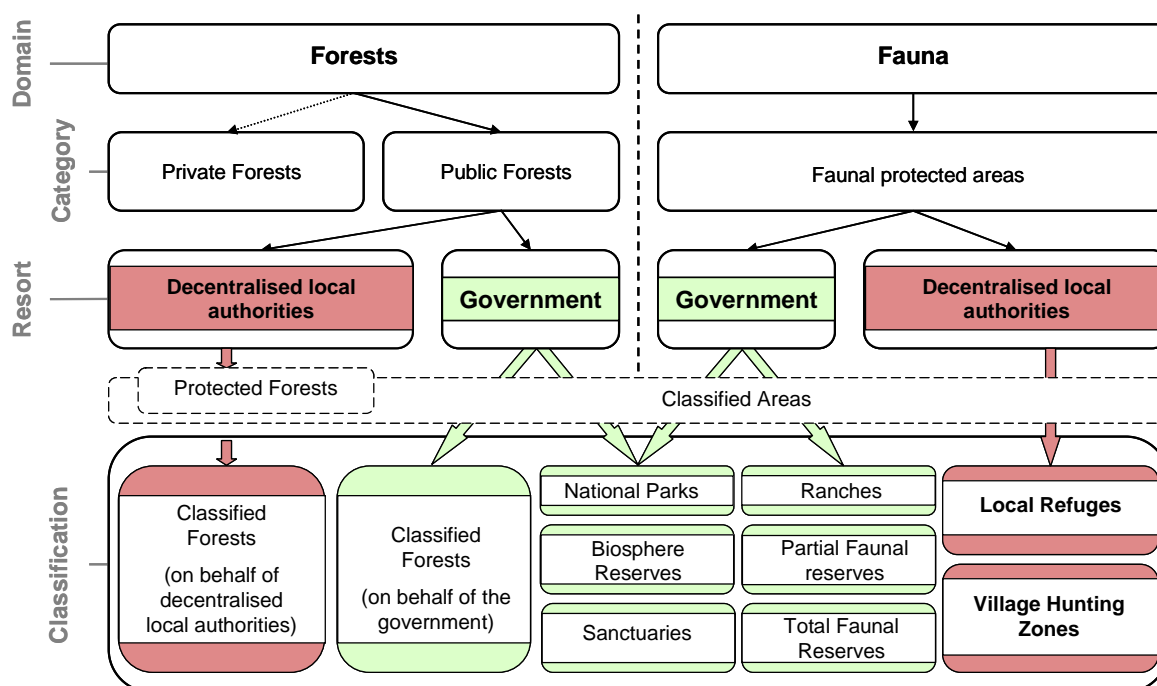
Source: **Décret N° 111/PRES du 17 mars 1997 portant promulgation de la loi n° 006197/ADP du 31 janvier 1997.**

Fig. 3.2: Categorization of protected areas in Burkina Faso according to the Forestry Act of 1997. Areas managed under the authority of the government in green, areas managed under the authority of local authorities in red. Own compilation based on Décret No 111/PRES du 17 mars 1997 portant promulgation de la Loi No 006197/ADP du 31 janvier 1997

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                    │  Ministère de l'Environnement │
                    │  et du Cadre de Vie MECV      │
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                         SG Secrétariat General
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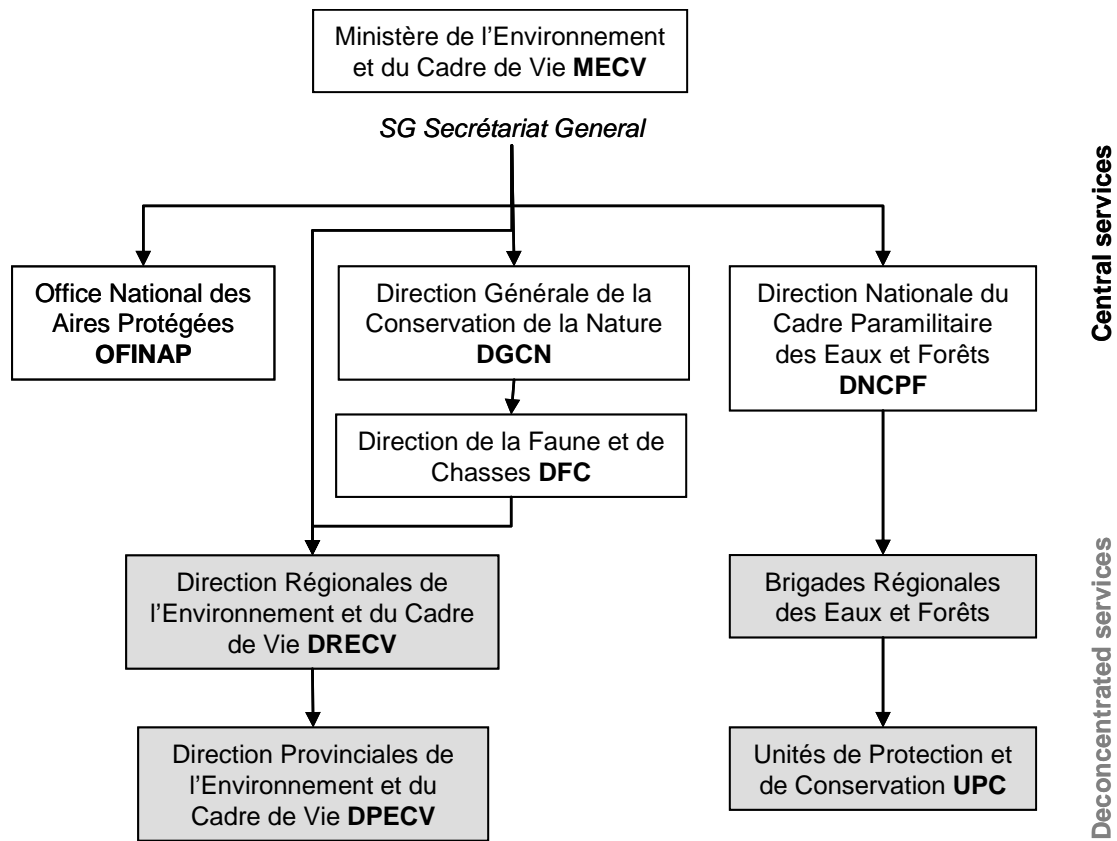
Fig. 3.3:. The organizational set-up of the governmental hierarchy in charge for PA management in Burkina Faso at the times of our study. Only organizations of major importance for the management of WAP-PAs are displayed (chart hence incomplete)
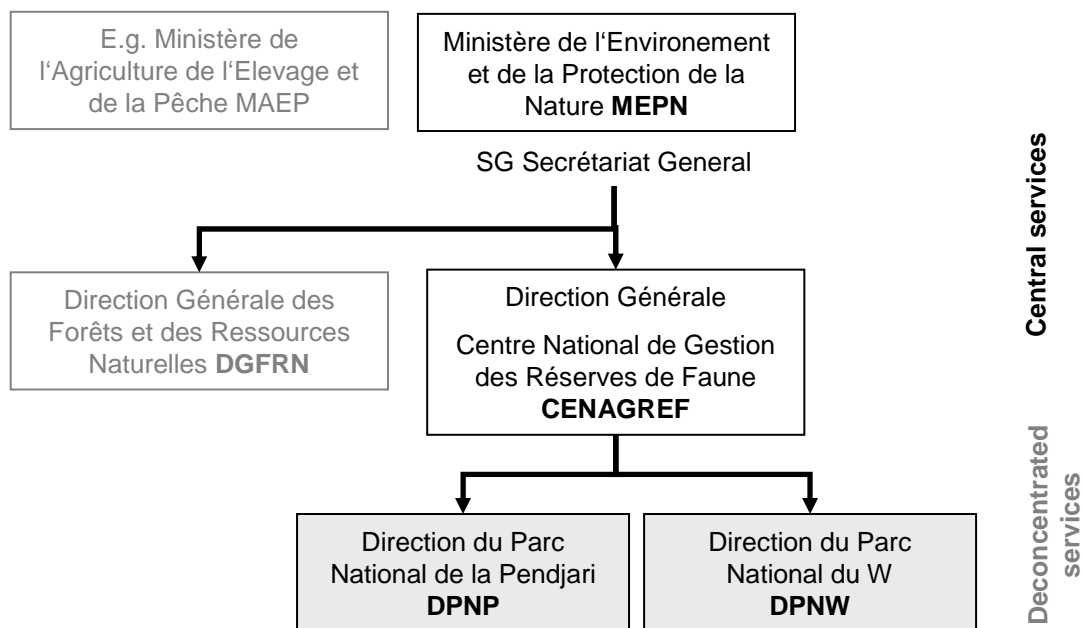
Fig. 3.4: The organizational set-up of the governmental hierarchy in charge for PA management in Benin at the times of our study. Only organizations of major importance for the management of WAP-PAs are displayed (chart hence incomplete)

Tab. 3.1: Important projects in the sector of PA management in Benin (only WAP)

Note: This table can only give rough information. Project implementation as well as funding structures are usually very complicated and often rely on the co-financing of different partners (including the national governments where project sites are located). Also project implementation dates are sometimes difficult to determine, as planning phases take a long time and different partners refer to different dates in their project documents.

Time frame	Name	Donor/ co-financing	Budget / Costs	Aim/ major achievements	Source
1974-1981	Développement des Parcs Nationaux- Bénin	FAO	830.000 US$	Capacity building, park infrastructure, surveillance and ecological surveys	DPNP/ CENAGREF 2005
1985-1990	Aménagement des Parcs Nationaux et Protection de l'Environnement-Bénin	5e FED/EDF European Development Fund	Ca. 300.000 US$	Demarcation of boundaries, establishment of law enforcement and park infrastructure, ecological research (e.g. vegetation map)	DPNP/ CENAGREF 2005
1993-1997/99	Projet de Gestion des Ressources Naturelles (PGRN)	Multi-donor funded, i.a. TWB and GTZ	24.4 Mio US $	First participatory experiments: financing pilot community-based wildlife and natural resource management operations in the communities adjacent to the protected areas.	TWB 2000
1999-2004	Projet Pendjari	GTZ	Part of PCGPN (see below)	Management of the Pendjari (i.a. management plan), establishment of AVIGREFs as strong representative of local interest	DPNP/ CENAGREF 2005
2000-2005	Programme de Conservation et de Gestion des Parcs Nationaux (PCGPN)	Multi-donor funded : GEF, France, The Netherlands, Germany, EU	25.9 Mio. US $	Establishment of national (CENAGREF) and local (AVIGREFs) capacities for effective co-management of the two national parks.	TWB 2006
2004-2014	ProCGRN	Germany (GTZ & KFW)		Projet Pendjari was integrated in ProCGRN (Component 2)	
2002-2005 (duration 20 months	*Eco-développement et Gestion de l'Espace des zones d'Influence des*	Implemented by IUCN and financed by the Dutch Cooperation	Part of PCGPN	Promotion of sustainable development in PA surrounding areas	Michel 2009, TWB 2006

, with interception of 1,5a)	*Parcs Nationaux* (PEGEI)				
2009-	Improving Natural Resource Governance for Rural Poverty Reduction (PAGREN)		660.000 US$ (planned)	Improving decentralised governance of natural resources, development and technical capacity in the periphery of W Benin	Savadogo 2009
2011-2016	Support to the Protected Areas Management Project	GEF/ IDA/ KfW	7.3 Mio US$ (planned)	Mainly provide transition funding for biodiversity conservation activities in both parks after closing of ProCGRN and PCGPN and until the establishment of the West African Savannah Foundation (trust fund) to ensure its operationalization by project closure	GEF 2010

Tab. 3.2: Important projects in the sector of PA management in Burkina Faso (only WAP)

Time frame	Name	Donor/ co-financing	Budget / Costs	Aim/ major achievements	Source
2000-2005	PAUCOF	AFD/FFEM	Ca. 2.5 Mio Euro	Support of the hunting areas of the Arly Block; i.a. promotion of hunting business by participation of private concessionaires to international game fairs	MECV 2006
2002-2007 (first phase)	PAGEN	World Bank/ GEF	13.5 Mio US$	National and local capacity building for the conservation of critically important ecosystems through community based management system; WAP not included; however implications for all PAs in BF: drafting of the National Program for Fauna and Protected Area Management (PNGFAP)	TWB 2008 (ICRR)
2005-2009	The Dryland Livestock Wildlife Environment	GEF/ UNEP	3.4 Mio US$	Kenya & BF; Project area in BF: Arly; decrease of degradation and conflict associated with livestock	http://www.thegef.org/gef/project_detail?projID=239

| | Interface Project | | | management in the PA periphery. | 6 |

Tab. 3.3: Interregional projects covering WAP

Time frame	Name	Donor/ co-financing	Budget / Costs	Aim/ major achievements	Source
2001-2008	Ecosystèmes Protégés en Afrique Sahélienne (ECOPAS)	EU	Total 24 Mio Euro, part of PCGPN	Transfrontier conservation and management (including management plan); focus on park infrastructures, surveillance activities	CENAGREF 2008
2004-2007	Building Scientific and Technical Capacity for Effective Management and Sustainable Use of Dryland Biodiversity in West African Biosphere Reserves	GEF/UNESCO-MAB/ WWF et al.	Total (all countries): 6.5 Mio US$	Covered six biosphere reserves in Benin (Pendjari), Burkina Faso (Park W/Burkina and Bala Hippopotamous Pond), Côte d'Ivoire, Mali, Niger ("W") and Senegal; strengthen scientific and technical capacity for effective management of the biosphere reserves.	Nicholson 2010
2005-	Enhancing the Effectiveness and Catalyzing the Sustainability of the W-Arly-Pendjari (WAP) Protected Area System	UNDP/GEF/IUCN/ EU and others	26,7 Mio US$	Support of all management levels and enhanced sustainable regional co-ordination	http://www.thegef.org/gef/project_detail?projID=1197
2012-2016	Programme d'Appui aux Parcs de l'Entente (PAPE)	EU/ UNDP	19.1 Mio Euro	Regional Management of the WAP complex, optimizing benefits for the local population; succeeds ECOPAS	www.pnud.ne/lancementprogappuiparcentente.pdf

Annex 3.1: Summary formal stakeholder analysis

The following table summarizes the (formal) roles of the different actors involved in PA governance and management on a more abstract level and indicates their financial, respectively decision-making power. Collective choice arenas sometimes left only little space for free choice due to a high imbalance of powers of participants involved. This holds especially true for "macro collective choice arenas" (participants here were deconcentrated governmental services, private actors as well as vpbs) but was also the case for "micro collective choice arenas" (involving internal community stakeholders like vpbs, traditional authorities and resource users). The most relevant organizations for each group are listed per country at the end of respective sections.

Tab. 3.4: The formal role and associated powers of relevant stakeholders in the sector of PA governance and management

Governmental central authorities	
Role	Main actors in action arenas on constitutional choice level
	▪ provide institutional framework. i.e. laws on resource exploitation, establishment of PAs, co-management structure
	▪ attract external funding and engages in high-level arenas of cooperation with international partners
	▪ instruct and control lower levels of governmental services and private actors
	▪ ensure formal participation of local communities and access and benefit sharing with resource users
Power	Holds highest level of decision-making power and property rights
	▪ actor holding the utmost right to formally use coercive power for rule enforcement (passed on to deconcentrated services)
	▪ can interfere in action arenas on any level if necessary
	▪ limited financial power; strongly relying on financial back-up of projects
Burkina Faso	MECV, DGCN, DFC, DNVPV, OFINAP (see Fig. 3.2)
Benin	MEPN, CENAGREF, (DGFRN) (see Fig. 3.3)

Governmental deconcentrated administration	
Role	One of the main actors in action arenas on "collective choice" level with private actors and local communities (macro-level)

- ▪ implement rule settings adopted in constitutional arenas on the regional and local collective choice levels

- ▪ refine and adapt formal rule settings to local conditions for operational arenas, e.g.:

  - - Distribute financial benefits to local communities

  - - Organise surveillance and other management tasks

- ▪ provide arenas for information exchange (bottom-up and top-down) and conflict resolution on collective choice and operational level

Power	Centre position in strict hierarchy: little upward power, but high downward power
Burkina Faso	DRECV, DPECV, Brigade Régional des Eau et Forêts, UPC
Benin	DPNP, DPNW

Governmental park rangers

Role	Implementing organs of the governmental hierarchies; playing hence an important role foremost in operational action arenas; often supported by assistant rangers coming from local communities (see e.g. Poppe 2012) ; according to governance system, these assistant rangers take over varying degrees of responsibility from governmental rangers ▪ monitor resource user behaviour ▪ enforce legal rules concerning property rights and restrictions ▪ carry out management task on behalf of the state (e.g. ecological monitoring) ▪ might be involved in action arenas of participation, depending on organisational set-up of PA governance
Power	Often organised in a paramilitary way, they are de facto almost omnipotent in operational arenas with local resource users; might enforce rules/ their interests with violence
Burkina Faso	Forestiers, pisteurs
Benin	Forestiers, éco-gardes, gardes-faunes, pisteurs

Local governments

Role	Supposed to be one of the main actors in action arenas on "collective choice" level with deconcentrated services and private actors; represent will of local resource users, legitimized by democratic elections ▪ are in charge for resource exploitation on communal land ▪ promote development of their communes

	▪ bundle needs and concerns of local resource users as citizens; give them a voice
Power	Very little financial and decision-making power
	▪ areas being established as PAs by governmental authorities are beyond formal sphere of influence of local governments
	▪ limited capacities due to small human and financial capital; new actor on the ground still in phase of preparation and organisation at the time of our study
Burkina Faso	Maires, Conseils Municipaux
Benin	Maires, Conseils Municipaux

Local communities	
Role	Organised as committees or associations (village participatory bodies, vpb); factually most important representative of resource users in action arenas on collective choice and operational level.
	▪ recipient of compensation payments for being excluded from resource exploitation through PA existence & final instance to redistribute benefits on most local level to resource users
	▪ regulating and controlling resource access and withdrawal rights on resource user level
	▪ exert social control to enhance formal rule compliance
	▪ carry out/ take part in operational PA management tasks
	▪ link resource users to actors of PA management
Power	If not supported by project interventions, virtually no power to push their claims in respective arenas with governmental or private actors; inter-village unions of vpb can enhance level of power.
	Within villages vpbs enjoy relatively high level of power due to their role as administrators of compensation payments paid by governmental services/ private actors.
Burkina Faso	CVGT, CVD, CVGF[1] et al. (see Chapter 7)
Benin	AVIGREF [2] et al. (see Chapter 7)

Traditional authorities	
Role	The role of traditional authorities on an informal basis is locally and regionally very high; due to its complexity an in-depth analysis is

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[1] CVGT= *Commission Villageoise de Gestion de Terroir*
CVD= *Commission Villageoise de Développement*
CVGF= *Comités Villageois de Gestion de la Faune*

[2] AVIGREF= *Association Villageoise de Gestion des Réserves de Faune*

	beyond the scope of this research (see e.g. Kesseler forthcoming, Volk forthcoming); function and importance of village elders strongly differed with locality and ethnic group in our study.
Power	Informal power on decision making processes in village communities generally high, e.g. concerning the investment of compensation payments

Resource users

Role	Ambivalent role: while there is some willingness for conservation efforts (especially if benefits for communities/ individuals are generated), resource exploitation interests usually dominate. From the macro perspective, individual resource users rarely play an active role in collective choice arenas with private concessionaires and deconcentrated services (participation via vpbs). However, to some degree collective choice arenas are also realized within village communities, and outcomes are forwarded by vpbs to collective choice arenas on macro-level; participation in operational activities is frequent, e.g. participation in surveillance activities.
Power	No decision-making power in collective action situation on macro level; influence on micro level depends on social and economic status.
Burkina Faso	Farmers & pastoralists et al.
Benin	Farmers & pastoralists et al.

Private actors

Role	One of the main actors in action arenas on "collective choice" level with private actors and local communities; impact often indirectly via governmental services ▪ Run business of commercial sports hunting in designated hunting areas ▪ Generated income provides basis for financial participation of local communities and covering of costs associated to management activities. ▪ Are obliged to establish and maintain touristic infrastructure ▪ Are supposed to support local development
Power	Financial power very high; often well integrated in influential business and politics networks on national level
Burkina Faso	Concessionaires, guides chasse, pisteurs
Benin	Amodiataires, guides chasse, pisteurs

Chapter 4

Annex 4.1: Geo- and biophysical context

Precipitation and fire are key abiotic environmental factors (Analysis based on data kindly provided by "The Assessment of African Protected Areas", Joint Research Center (JRC))

Being situated in the transition zone between the Sahel and the Sudanian Zone, the region is marked by high climatic variability within and between years. These variances strongly influence resource availability and human exploitation patterns, e.g. concerning pastoral activities, hunting or human induced fire regimes. Accordingly vegetation periods as well as animal life cycles and behaviour are submitted to these conditions, influencing e.g. large mammal population densities and migration movements (Bouché 2007, Cornélis 2011). Impacts of climate change are already occurring throughout the region, and resulted i.a. in enhanced climatic variability and a 200 km southward shift of isohyets (Niasse et al. 2004). Further global warming probably will even more intensify these effects and consequently impact ecological systems as well as contribute to high uncertainty concerning agricultural exploitation.

For the purpose of this study, we analysed some key variables namely rainfall, existence of open water bodies and fire regimes. Data compiled and pre-treated by the JRC project *The Assessment of African Protected Areas* was kindly provided to our project for this assessment. The project aims at "a large scale assessment of protected areas using objective continent-wide data sets and methodologies as opposed to case studies on individual parks or global assessments." (APAAT website 2012). It thereby largely relies on remote-sensing derived data. For more information on Materials & Methods see: http://bioval.jrc.ec.europa.eu/APAAT/

Climate in the WAP region is generally marked by three seasons. From November to the end of February it is dry and cold, from March to the end of May it is dry and hot (mean temperature in May around 30°C), and the period from June to October represents the rainy season (Bouché 2007) with monthly average rainfall that may well exceed 200 mm in August.

Hydrological regime

Being located in the transition zone of Sahel and Sudan, average rainfall varies between 750 mm per annum in the northern and 1020 mm in the southern parts of the complex and is highly prone to inter-seasonal and inter-annual variability. As water availability can be considered the main limiting factor for system productivity, we analysed actual spatial and temporal distribution of rainfall, photosynthetic activity, and open water bodies. Results showed a clear negative trend from subcomponents in the South (average yearly rainfall from 1995 to 2008 in Pendjari: 1019 mm, SD 146) to the North (average yearly rainfall from 1995 to 2008 in: Tamou 735 mm, SD 77) for rainfall, with a prolonged rainy season in the southern parts (see **Fig. 4.5**). Rainfall in the transition period between dry and the rainy season showed to be more stable during the years in these zones.

Pendjari | (from July) **1995-2008** (to Aug.)

Monthly Mean	rain	NDVI
January	2	78,2
February	5	73,6
March	14	72,2
April	58	79,0
May	127	99,5
June	140	137,8
July	184	161,6
August	241	158,8
September	184	186,5
October	52	183,3
November	6	134,7
December	1	94,3
Yearly mean sum	**1019**	

W Niger | (from July) **1995-2008** (to Aug.)

Monthly Mean	rain	NDVI
January	0	83,0
February	1	75,9
March	7	71,6
April	31	73,2
May	74	83,3
June	118	103,9
July	173	134,7
August	200	157,9
September	117	173,6
October	29	147,6
November	2	111,5
December	1	94,5
Yearly mean sum	**762**	

Fig. 4.5: Climate diagrams of Pendjari NP and W Niger NP. For the other blocks of WAP see Fig. 4.14 in Annex.

As climate is characterized by high differences between dry and wet season, availability of open water bodies becomes a key resource for large mammal populations. We therefore assessed persistence of this variable and found very different regimes, depending on the existence of (perennial) river systems (see **Fig. 4.6**). Most areas thus face severe temporal and spatial drought stress, especially during the dry season. Exceptions are the Arly Total Reserve, the Pendjari and W Niger that can keep open water bodies almost all year, though also experiencing significant loss in spatial coverage. At least during the dry season, concentration of migratory species in these PAs can be expected. However, so far there is only limited to no data available on migration movements of large mammal species (see e.g. Ipavec 2007; Chapter 8).
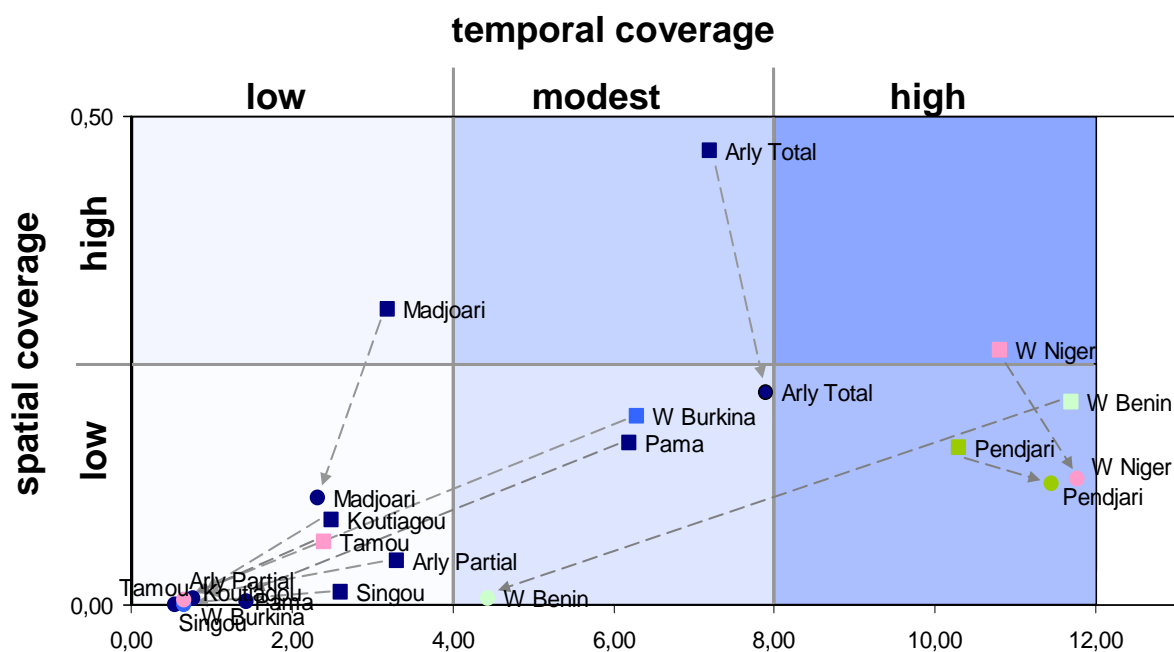
Fig. 4.6: Spatial and temporal coverage of open water bodies (mean 1999-2008). Dots give mean values for the dry season, quadrates indicate values for the wet season; X-Axis gives mean number of reference decades, in which open water bodies have been detected (max 18 for each season), Y-Axis gives mean percentage of spatial coverage relative to size of PA.

There are two water catchment areas. The southern part, i.e. Blocks Arly and Pendjari, is drained via the Pendjari/ Oti into the Volta Basin, whereas the northern part, i.e. the three blocks of Park W, belongs to the Niger basin. Most tributaries are not perennial

41

and run dry during the dry season (see **Fig. 4.7,** for elevation model see Fig. 4.11 in Annex).
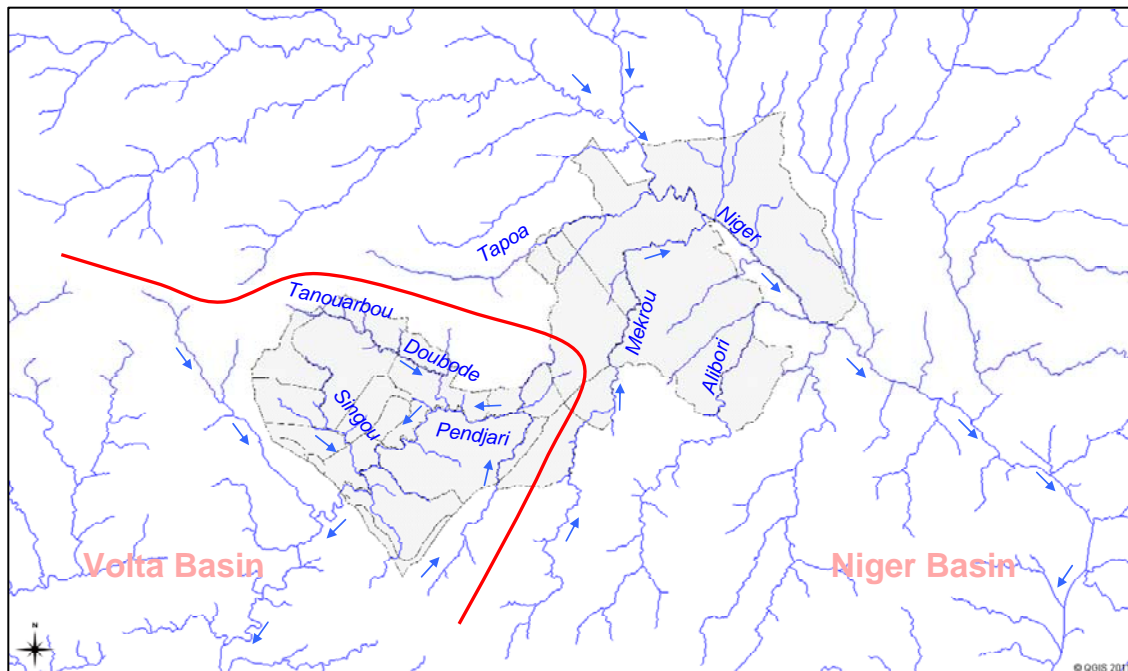
Fig. 4.7: Hydrological features of the WAP complex. The red line indicates the watershed between the areas.

Fire regime

Bush fires are an important element of ecosystem dynamics in West-African savannah areas (Goldammer 1997), and played an important role in shaping community structures and ecosystem functions. For centuries, humans used fire as a management tool in their agricultural and pastoral systems (Makela & Hermunen 2007), and so likely have changed naturally occurring fire regimes (Theis et al. 2003). Effects of these changes remain debated, as well as how to best apply well adapted human induced fire regimes.

Without getting into this discussion, we want to introduce some of the key characteristics of bush fire occurrence in the WAP. As in most PAs of the biome, PA managers of the WAP also used it as a tool for different purposes: to potentially ameliorate forage for large ruminants, to enhance visibility of animals for tourists and hunter tourists, and to avoid late bush fires of high intensity by burning combustive biomass (grass) in the early dry season. Gregoire & Simonetti (2010) found a significant increase in fire density in several PAs of West Africa (including parts of WAP) in the first

decade of this century, potentially indicating further man-made alterations that impact these areas.

Two main variables[3] covering the time span from 2004 to 2008 have been assessed for the purpose of the study: 1) fire count, which gives the total number of fire pixels detected in the MODIS satellite images per decade (ten days) (see Fig. 4.8); and 2) fire density for each single PA, which describes the number of fire pixels per 1,000 ha per decade (**see Fig. 4.8**). Though fire pixel count can give valuable information on temporal distribution of fires within the fire season, fire density per 1000 ha per decade was analysed to ensure spatial comparability of the data between PAs. General methodology is analogous to the one used by Grégoire & Simonetti (2010).
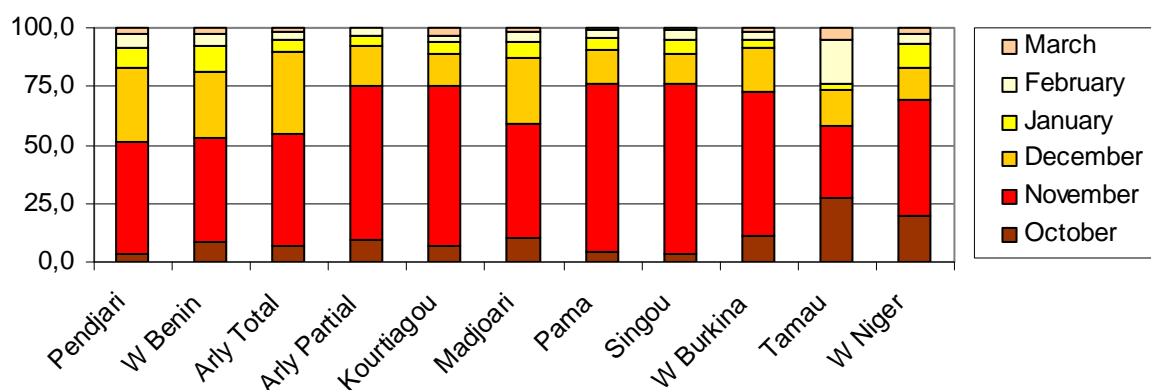
Fig. 4.8: Spatial and temporal distribution of fires in the WAP complex. Data is based on mean values for four consecutive years (2004-2008) and is displayed as relative abundance to the total fire count for the whole season (lasting from October to the end of March).

The fire season generally lasts from October to March. Fire frequency in October is still relatively low, but then rapidly increases and peaks during November. At the end of December usually far more than 75% has taken place and frequency then rapidly declines (see **Fig. 4.8**).

Unfortunately the data available refers to de jure PA classification and not to de facto management units. Additionally, as shown in the previous paragraph, there are different water regimes in place that of course have impact on respective fire regimes. Comparison between different zones can hence only be made with caution. Dynamics of fire regimes within the fire season (2004-2008) can be seen in **Fig. 4.9**. Data indicate that private concessionaires (Arly Partial Reserve, Kourtiagou, Pama, Singou) have

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[3] All results presented here are based on fire data kindly provided and pre-treated by the Joint Research Center of the European Union. Comprehensive data sets can be downloaded via internet from their homepage (for details see: http://gem.jrc.ec.europa.eu/).

higher interest in burning their area early in the fire season and so to have ideal conditions when the hunting season starts (December). Fire densities confirm this trend with Koutiagou having exceptional high fire densities in November .
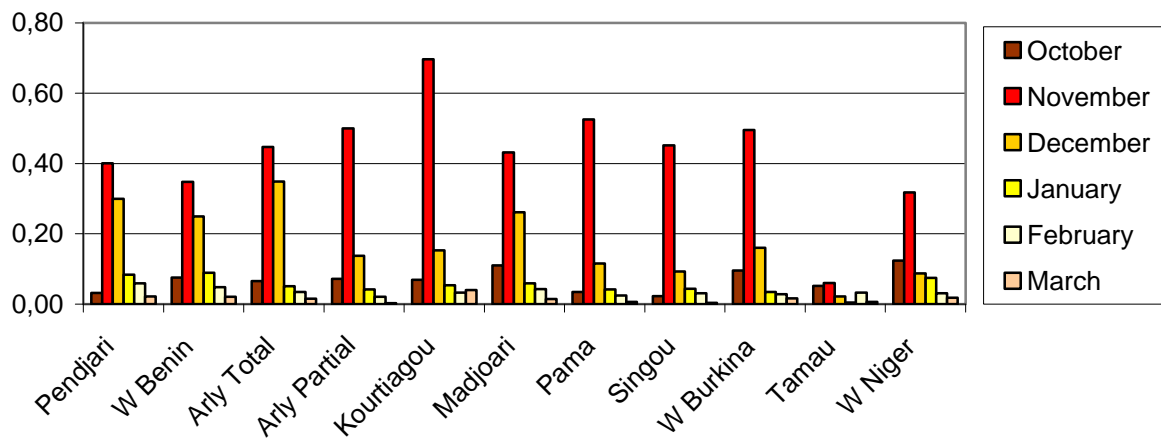
Fig. 4.9: Mean fire density from 2004-2008 during the fire season. Data gives mean number of fires detected per 1000 ha per decade.

Figure 4.10 below gives an overview of fire regimes during the year. There is usually high spatial and temporal coverage during the first half of the burning season (October to December), which changes in most cases to a lower spatial coverage while maintaining high to moderate temporal coverage during the second half of the dry season (January to March). Finally during the wet season (April to September), fire intensities drop to low spatial and temporal coverage.
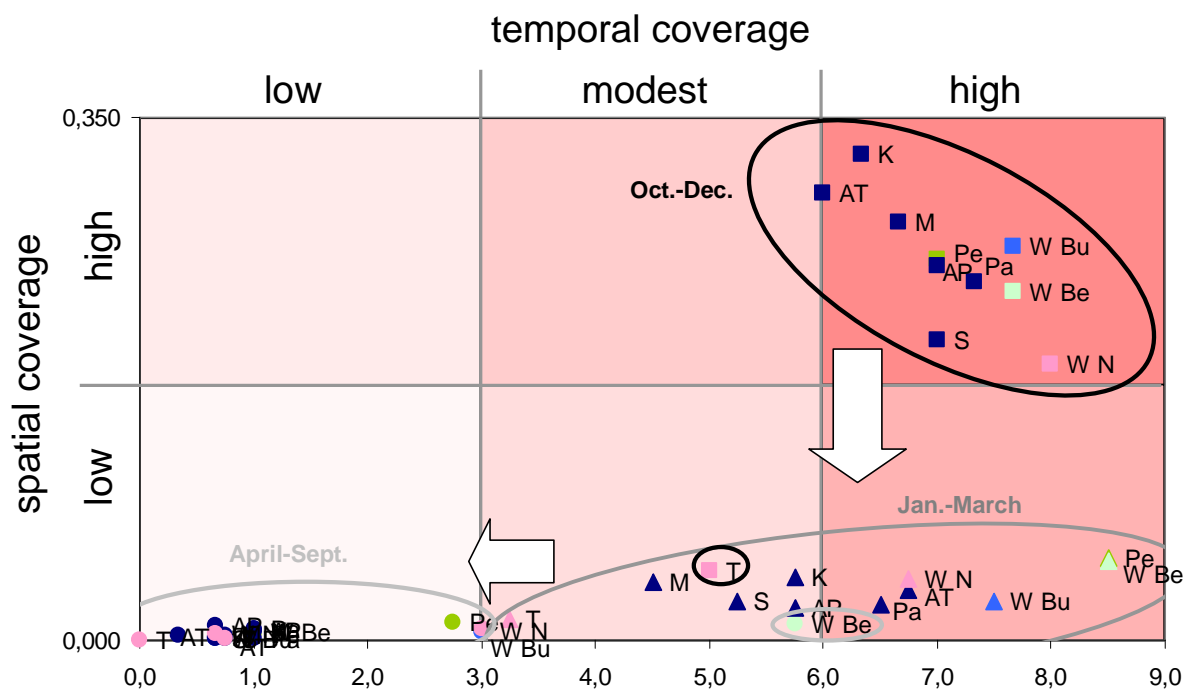
Fig. 4.10: Temporal and spatial fire distribution throughout the year, divided in four parts (Jan.-March; April-July; Aug.-Sept.; Oct.-Dec.; as data points for April-July and Aug. Sept. lied very close to each other, only one category called April-Sept. is being displayed in the graph). Spatial coverage on the y-axis gives mean fire density in these time periods, whereas temporal coverage on the x-Axis gives mean number of decades with presence of fire pixels in the respective period. Quadrates give mean values for the first half of the dry season, triangles for the second half, and dots for the wet season. X-Axis gives mean number of reference decades, in which fires have been detected (max 9); Y-Axis gives mean percentage of spatial coverage relative to size of PA.

More details on fire regimes of the WAP-complex can be found in Grégoire & Simonetti (2007) and Grégoire & Simonetti (2010).
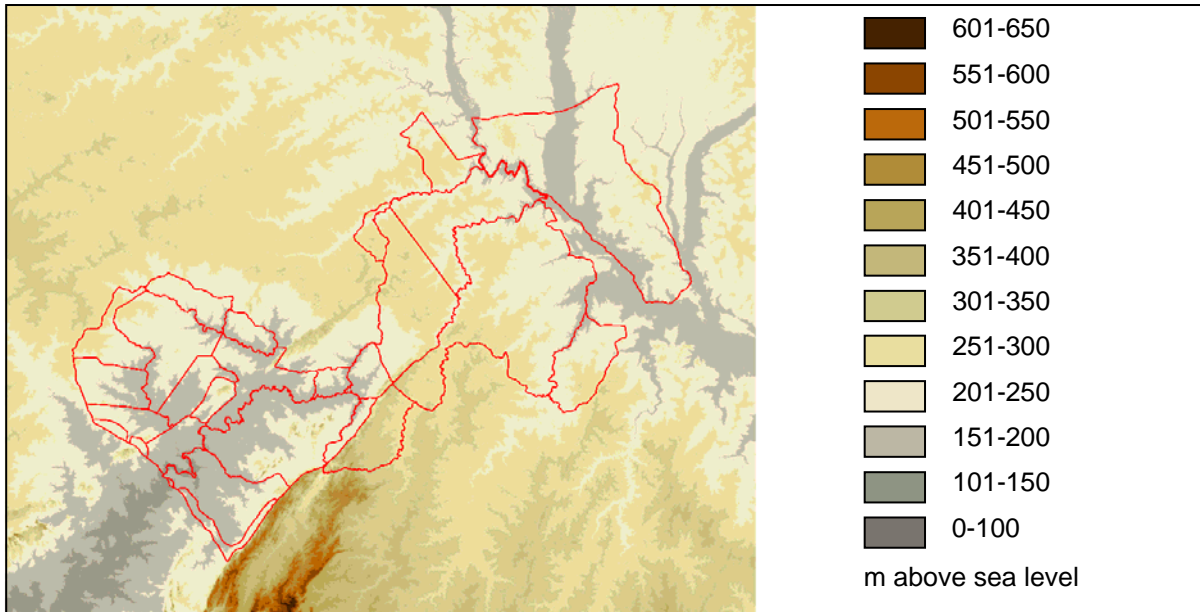
Fig. 4.11: Elevation model of the study region

Structure UPC Burkina Faso, Région de l'Est
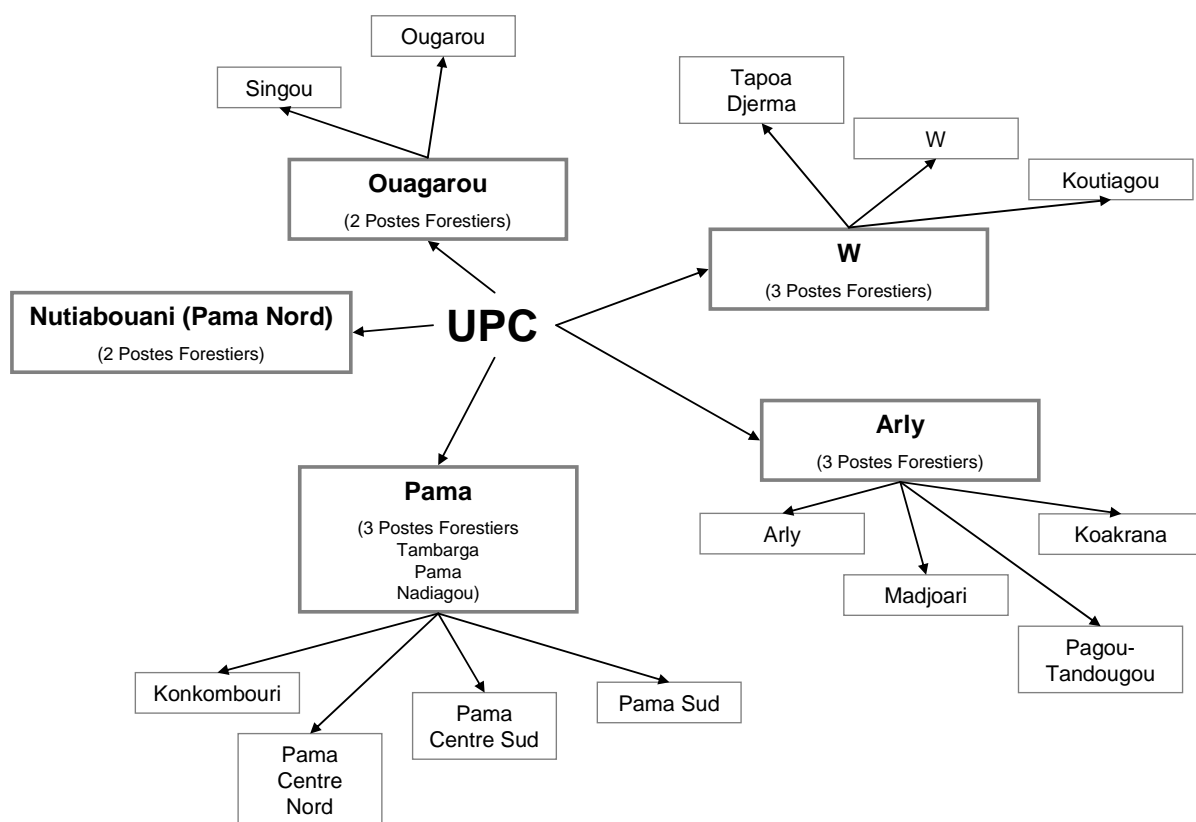
Fig. 4.12: Organisational structure of Wildlife Conservation Units that existed in eastern Burkina Faso at the time of our study

Tab. 4.2: Demographic, socio-economic and development indicators of Benin and Burkina Faso

	Burkina Faso	Benin	Year
Population total	17 Mio	9 Mio	2011
[1]Life expectancy at birth, total (years)	55,4	56	2011
[1]Children under 5 moderately or severely underweight (%)	37,4	20,2	2006
[1]Literacy rate, adult total (% of people ages 15 and above)	28,7	42,6	2007 (BF); 2010 (Benin)
[1]Rural population (% of total population)	73,5	55,1	2011
[2]Proportion of urban population living in slums	59,5	70,8	
[1]Access to electricity (% of population)	14,6	24,8	2009
[1]Population ages 0-14 (% of total)	45,2	43,7	2011
[1]Population growth (annual %)	2,9	2,8	2011
[2]Proportion of population below $1 per day	56,5	47,3	2003
[1]Income share held by highest 20%	47	46	2003

Sources: [1] World Development Indicators (databank.worldbank.org; download 12.02.2012); [2] Millennium Development Goals (mdgs.un.org; download 12.02.2012)

Tab. 4.3 : Socio-demographic and socio-economic data of respondents of hh survey, village level

	Village 1	Village 2	Village 3	Village 4	Village 5	Village 6	Village 7	Village 8	Village 9	Village 10
					Block Arly					
Mean hh size	9,1	11,5	12,5	9,9	8,9	8,2	8,1	7,8	8,7	9,7
SD	2,9	8,4	13,7	5,2	2,6	2,9	2,9	2,9	2,8	5,0
Men	20	21	23	20	21	21	21	20	25	20
Women	30	31	31	29	27	26	24	24	28	29
Children	131	177	209	149	139	125	125	112	129	136
Mean age of hh head	42,7	57,1	47,0	53,7	57,3	55,3	52,6	53,4	52,4	49,4
SD	17,8	25,7	12,0	15,1	12,4	9,9	10,4	10,6	16,3	11,9
Ethnic composition % of respondents										
Gourmantché	40,0	100	57,1	60,0	100	52,4	100	50,0	100	47,4
Peulh	50,0	0,0	42,9	40,0	0,0	47,6	0,0	50,0	0,0	52,6
Mossi	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Dendi	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Tchenga	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Djerma	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Houssa	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Mokolé	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Bariba	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Adja	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Biali	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Wama	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Berba	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Cultivated area per hh in ha	2,9	3,0	3,7	3,6	3,6	2,8	3,4	3,3	3,4	3,3
SD	1,2	2,0	2,5	2,1	2,1	1,4	1,0	1,7	1,9	2,7
Hh cultivating cotton (%)	5,0	50,0	28,6	35,0	57,1	38,1	23,8	50,0	28,6	15,8
Mean number of cattle per hh	11,4	1,1	11,8	17,0	7,0	25,6	18,3	31,1	6,4	16,3
SD	10,0	3,4	14,7	21,5	8,7	14,3	28,5	25,3	10,6	12,1
Residence time (% of respondents)										
0-10 years	26,3	5,3	5,0	18,8	0,0	4,8	5,6	0,0	0,0	0,0
10-20 years	5,3	10,5	10,0	6,3	0,0	57,1	94,4	0,0	0,0	61,1
More than 20/native	63,2	84,2	85,0	75,0	100	38,1	0,0	100	100	38,9
Member of committe (%)	20,0	5,0	0,0	15,0	0,0	0,0	4,8	0,0	9,5	10,5
Education (%)										
No formal education	100	100	100	100	100	100	100	100	100	100
Primary education	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Secondary education	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

	Park W Burkina				
	Village 11	Village 12	Village 13	Village 14	Village 15
Mean hh size	7,4	6,4	8,5	11,1	9,3
SD	4,5	4,5	4,3	4,7	3,9
Men	20	20	20	22	20
Women	27	22	25	32	33
Children	100	86	125	167	133
Mean age of hh head	45,7	42,0	47,3	52,6	42,1
SD	18,4	20,6	24,6	23,6	21,0
Ethnic composition % of respondents					
Gourmantché	50,0	50,0	60,0	95,0	100
Peulh	50,0	50,0	40,0	5,0	0
Mossi	0,0	0,0	0,0	0,0	0,0
Dendi	0,0	0,0	0,0	0,0	0,0
Tchenga	0,0	0,0	0,0	0,0	0,0
Djerma	0,0	0,0	0,0	0,0	0,0
Houssa	0,0	0,0	0,0	0,0	0,0
Mokolé	0,0	0,0	0,0	0,0	0,0
Bariba	0,0	0,0	0,0	0,0	0,0
Adja	0,0	0,0	0,0	0,0	0,0
Biali	0,0	0,0	0,0	0,0	0,0
Wama	0,0	0,0	0,0	0,0	0,0
Berba	0,0	0,0	0,0	0,0	0,0
Cultivated area per hh in ha	4,6	2,6	3,7	4,8	5,1
SD	3,0	2,0	2,4	3,4	2,2
Hh cultivating cotton (%)	5,0	0,0	5,0	0,0	5,0
Mean number of cattle per hh	8,9	6,4	22,6	10,6	3,4
SD	10,9	7,4	49,3	16,6	5,6
Residence time (% of respondents)					
0-10 years	35,0	0,0	15,0	20,0	35,0
10-20 years	15,0	5,0	5,0	20,0	35,0
More than 20/native	50,0	95,0	80,0	60,0	30,0
Member of committe (%)	5,0	0,0	10,0	10,0	15,0
Education (%)					
No formal education	100	100	100	100	100

Primary education	0,0	0,0	0,0	0,0	0,0
Secondary education	0,0	0,0	0,0	0,0	0,0

	Park W						Pendjari				
	Village 16	Village 17	Village 18	Village 19	Village 20	Village21	Village 22	Village 23	Village 24	Village 25	Village26
Mean hh size	11,4	7,6	7,9	9,1	11,7	10,0	12,3	14,9	13,2	9,5	11,9
SD	4,7	3,4	4,5	6,2	6,0	6,0	5,2	33,7	7,9	4,9	5,9
Men	20	20	23	26	26	28	47	24	46	47	53
Women	30	28	27	33	39	44	52	32	56	58	42
Children	177	104	132	178	239	207	159	120	175	103	96
Mean age of hh head	47,4	46,8	42,2	46,6	41,5	43,6	44,6	41,8	47,4	41,7	53,6
SD	8,4	14,2	8,4	15,6	10,0	14,0	7,7	9,5	10,9	14,3	11,1
Ethnic composition % of respondents											
Gourmantché	5,0	60,0	4,3	3,8	0,0	0,0	0,0	0,0	0,0	0,0	100
Peulh	50,0	25,0	26,1	19,2	19,2	21,4	4,8	0,0	4,8	0,0	0,0
Mossi	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Dendi	35,0	5,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Tchenga	5,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Djerma	5,0	5,0	8,7	7,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Houssa	0,0	5,0	8,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Mokolé	0,0	0,0	43,5	0,0	0,0	3,6	0,0	0,0	0,0	0,0	0,0
Bariba	0,0	0,0	8,7	65,4	80,8	75,0	0,0	0,0	0,0	0,0	0,0
Adja	0,0	0,0	0,0	3,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Biali	0,0	0,0	0,0	0,0	0,0	0,0	95,2	0,0	85,7	0,0	0,0
Wama	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100	0,0	100	0,0
Berba	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	9,5	0,0	0,0
Cultivated area per hh in ha	4,4	3,9	4,3	3,0	6,1	7,6	5,6	2,6	5,6	3,7	3,5
SD	2,2	3,1	2,5	0,6	3,2	3,2	2,3	1,4	2,3	2,2	1,6
Hh cultivating cotton (%)	15,0	50,0	56,5	80,8	96,2	96,4	19,0	27,3	33,3	59,1	75,0
Mean number of cattle per hh	22,3	9,2	5,3	13,1	13,5	11,2	9,2	0,0	6,2	0,7	1,3
SD	29,5	14,1	9,7	31,6	14,2	15,2	21,3	0,0	19,9	1,0	2,4
Residence time (% of respondents)											
0-10 years	0,0	0,0	0,0	19,2	15,4	32,2	0,0	0,0	0,0	9,0	0,0
10-20 years	5,0	0,0	8,6	19,2	0,0	46,4	0,0	0,0	0,0	9,0	0,0
More than 20/native	95,0	95,0	91,4	61,5	84,6	21,5	100	100	100	81,8	100
Member of associ. (%)	20,0	10,0	26,1	26,9	3,8	42,9	71,4	61,9	71,4	85,7	87,5
Education (%)											

No formal education	80,0	80,0	69,6	69,2	84,6	71,4	81,0	40,9	81,0	72,7	75,0
Primary education	10,0	10,0	13,0	23,1	11,5	25,0	4,8	40,9	4,8	22,7	12,5
Secondary education	0,0	0,0	0,0	7,7	0,0	3,6	9,5	0,0	9,5	0,0	0,0

Annex 4.2: Human population densities

▪ **Densities & growth rates**

Human population growth and associated exploitation pressures are the root causes of environmental degradation and biodiversity loss. In order to better understand regional institutional and organisational differences and threats, we hence analysed human population densities on a complex wide scale and so to identify potential hot spots of pressure.

Data on human population density was provided by the African Population Database Documentation. This project is run by the Center for International Earth Science Information Network (CIESIN) of the Columbia University and the United Nations Environment Programme/ Global Resource Information Database (UNEP/GRID), Sioux Falls. In 2004 the fourth version (which has been used here) was compiled from a large number of heterogeneous sources and published as GIS-data layers. It provides population estimates with a 2.5 km resolution for the years 1960, 1970, 1980, 1990 and 2000. The methodology of estimating and extrapolating population numbers for the administrative units relies on an algorithm that calculates the accessibility of any grid cell. This index in turn is based on data on transportation networks and the formation of urban centres. For details see Nelson (2004). We used this data to analyse the evolution of human population numbers around the WAP complex from 1960 to 2000 on a general level, and to calculate PA specific threat indicators.

The calculation of these threat indicators and the modelling of PA buffer zones correspond to the analysis of agricultural threats in Chapter 8. More details on the following procedure can be found there.
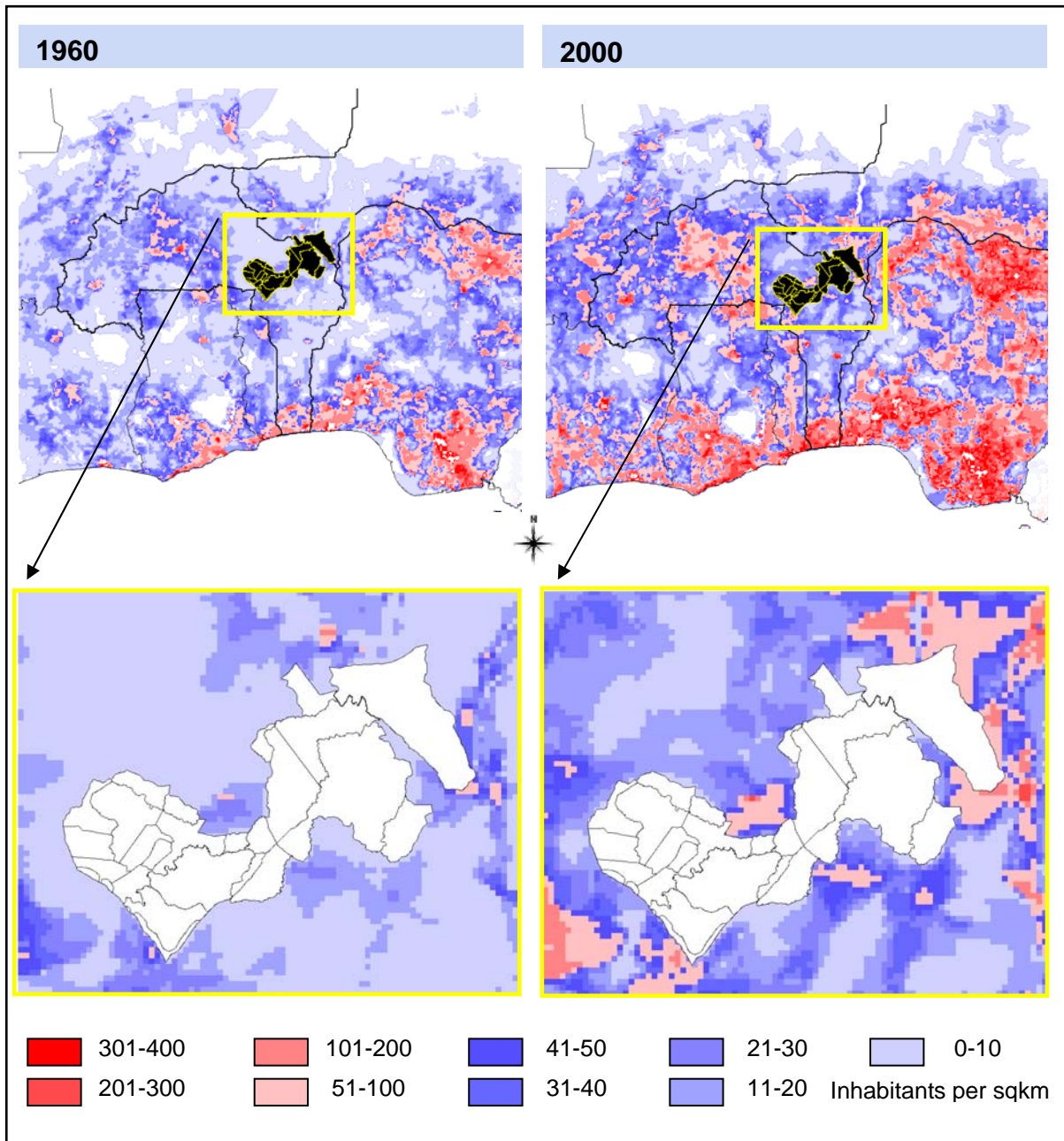
Fig. 4.13: Human population density in the vicinity of the WAP complex in the years 1960 and 2000. The two maps on top show population densities in the whole region including Burkina Faso, Ghana, Benin, Togo, Nigeria and the southern part of Niger (WAP complex in black). The two enlargements below show the close vicinity of the complex in Burkina, Benin and Niger (WAP complex in white).

Data on PA boundaries was provided by courtesy of JRC (Jean-Marie Gregoire) and the ECOPAS project, as well as by the Ministry of Environment of Burkina Faso. Borderlines correspond to de facto management units, not to official status and classification of sites. With the help of further cartographical material provided by ECOPAS, the Pendjari Project and IUCN, the material was quality-checked and

demarcations of PA boundaries were slightly modified in some parts. Borderlines e.g. were more closely adjusted to natural features like the course of the Pendjari River. Furthermore, we excluded some areas from the original PA shapes, namely the "*Zone d'occupation controlee*" (ZOC; buffer zone) from the Pendjari hunting zone, as well as the enclaves around Pama and Madjoari in the Arly block.

We used GRASS open source software to construct PA buffer zones that comprised zones of 5 km and 30 km width exterior of the PA. As PAs in our case are clustered to a complex of about 20 interconnected units, we then reduced these buffer zones by cutting off those parts that were covered by a neighbouring PA. The resulting exposed buffers hence greatly varied in size depending not only on PA size itself, but also on PA position within the complex.

Using a GIS we overlaid population density maps and PA shapes including their buffer zones and calculated the mean population density for the different buffer zones. Due to the above mentioned fact of very different exposed buffer sizes, mean population density itself is not sufficient to express the degree of threat on single PA units. As some form of standardization we therefore multiplied the mean population density and the ratio of exposed buffer size to total buffer size. The resulting threat indicator can be used to (relatively) assess and compare threats caused by high human population densities among PAs.

According to the *World Population Prospects: The 2002 Revision* (UN 2002), total population size in Burkina Faso rose from 4.5 million in 1960 to 11.9 million in 2000. Relative growth in Benin has even been higher. The population there grew from 2.2 million in 1960 to 6.2 million in 2000. **Fig. 4.13** shows the modelled data that we used for our analysis. Thus in West Africa, population growth led to high densities along the coastline and its periphery, in the northern and southern parts of Nigeria and in the central part of Burkina Faso. The WAP complex still lies in a relatively remote area that is dominated by rural landscapes and relatively low population densities. Nevertheless population numbers rose significantly since 1960 and even tripled in some adjacent areas. The two enlargements in **Fig. 4.13** show this development in more detail. In some places population densities rose from just a few inhabitants per km^2 up to 200-300 inhabitants per km^2. This holds especially true for areas in Niger, but also to a lesser degree around the Arly Block in Burkina Faso. Urban areas and their peripheries also grew and now exert immediate threat to some PAs of the complex, e.g. the area

south of W Benin (around Banikoara), south of the Pendjari Hunting Concession (around Tanguieta) and the area between the Arly Block and the W Burkina Faso (Province of Tapoa). Critical is also the settlement of about 10.000 people in the enclave of Madjoari lying right in the heart of the Arly Block (Monographie de la Commune de Madjoari 2006).

As there is modelled data available for each decade, we further analysed the pattern of growth in the immediate vicinity of the WAP (**Fig. 4.14**). Probably due to the effects of the Sahel droughts in the 1960ies to the 1980ies (migration), there have been high growth factors north of the complex, especially in Niger (though there is a large area with missing data). During the 1980ies, urban areas in Burkina Faso showed high growth factors, especially in the periphery of Fada N'Gourma, the Tapoa Province, in the commune of Madjoari and around Pama. The latter is supposed to be a consequence of the construction of the Kompienga Reservoir south of Pama. While growth in Burkina in the urban centres slowed down, there remained widespread rural growth during the 1990ies. However, most striking is the significant increase in growth in almost all areas adjacent to PAs in Benin during this period. The strong governmental promotion and structural reforms of the cotton sector played an important role for this development.
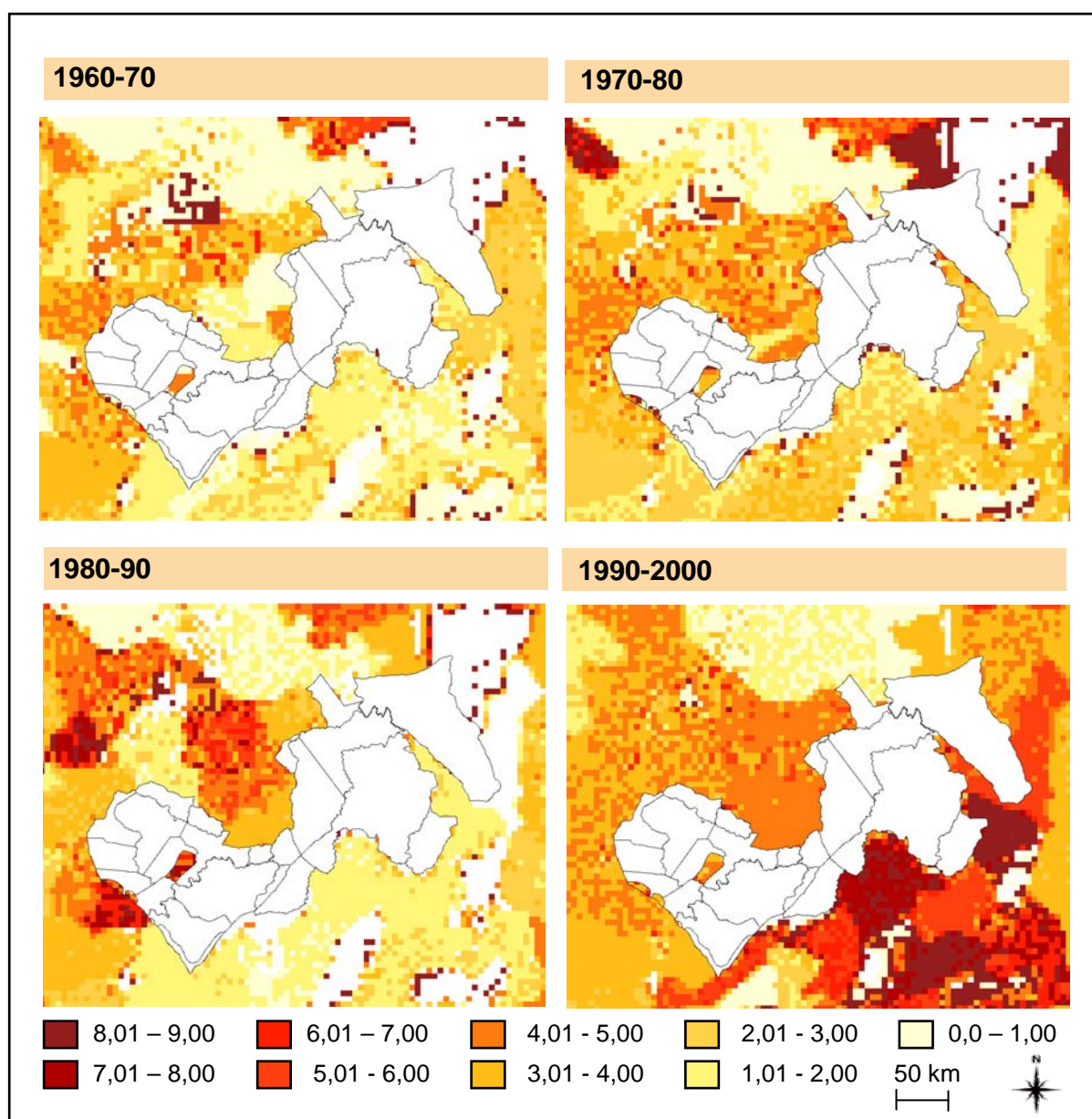
Fig. 4.14: Population growth in decennial steps. Colours give different growth factor categories.

▪ **Population threat indicator**

The evaluation of population densities in 5km buffer zones around PAs generated relative population threat indicators that express the degree of immediate threat by high population densities for each single PA. In 1960, they ranged from 0.0 for Konkombri (Block Pendjari) to 12.9 for Dosso (Block W Niger) for the 5km buffer zones and from 0.0 (Konkombri) to 46.4 (Dosso, Block W Niger) in the year 2000 (see **Tab. 4.4**).

Tab. 4.4: Population threat indicators in 5km and 30 km buffer zones around single PAs in 1960 and 2000

		5km			30km		
		1960	**2000**	**growth factor**	**1960**	**2000**	**growth factor**
Arly							
	Pama Nord	1.7	6.1	3.6	3.0	10.4	3.5
	Pama Centre Nord	1.0	3.5	3.5	2.5	9.3	**3.7**
	Pama Centre Sud	1.4	6.0	**4.3**	2.3	8.9	**3.9**
	Pama Sud	0.8	3.2	**4.0**	2.8	8.2	2.9
	Konkonbouri	0.5	2.0	**4.0**	0.5	2.0	**4.0**
	Singou	0.1	0.3	3.0	2.0	7.2	3.6
	Ougarou	1.7	5.1	3.0	2.8	9.3	3.3
	Pagou Tandougou	2.8	8.2	2.9	5.3	16.5	3.1
	Arly	2.8	8.5	3.0	3.3	10.5	3.2
	Koakrana	2.4	7.9	3.3	5.4	16.9	3.1
W Burkina							
	W Burkina	1.9	6.9	3.6	4.1	13.5	3.3
	Tapoa Djerma	3.4	**11.1**	3.3	3.8	13.2	3.5
	Koutiagou	3.2	11.0	3.4	5.2	16.7	3.2
W Benin							
	Mekrou	2.3	6.5	2.8	4.6	13.0	2.8
	W Benin	2.5	7.2	2.9	4.3	12.5	2.9
	Djona	**5.2**	**16.8**	3.2	**7.8**	**22.7**	2.9
Pendjari							
	Pendjari ZC	3.6	8.2	2.3	**7.6**	**17.1**	2.3
	Pendjari PN	0.1	0.3	3.0	2.6	7.4	2.8
	Konkombri	0.0	0.0		1.7	4.9	
Niger							
	W Niger	0.4	1.5	3.8	1.5	4.3	2.9
	Tamou	**6.2**	10.1	1.6	6.4	9.9	1.5
	Dosso	**12.9**	**46.4**	3.6	**12.5**	**42.7**	3.4

For more information on human population densities in the vicinity of WAP see Annex Chapter 4: "Human population densities"

For the 30 km buffer, values ranged from 0.5 in Konkombouri (Block Arly) to 12.5 for Dosso (Block W Niger) in 1960 and from 2.0 (Konkombouri) to 42.7 (Dosso, Block W Niger). The mean growth factor of the threat indicators between 1960 and 2000 for both, the 5km and the 30km buffer, is 3.2, respectively 3.1, showing that the indirect threat caused by population density in the PA outskirt area tripled on average. For some areas (the southern parts of Pama and Konkombouri), the intensities even quadrupled. The general picture for both buffer zones (5km and 30km) is very similar: those PAs facing high population threats in their 5km buffer zones also face high degrees of threat in their 30km buffer. The map in **Fig. 4.15** graphically illustrates the data by showing the relative degree of threat to each single PA (relative to highest threat indicator of all PAs,

i.e. Dosso in all cases). Here again we can see that the overall population pressure around WAP intensified, but the pattern of population threats among PAs hardly changed with spatial scale.
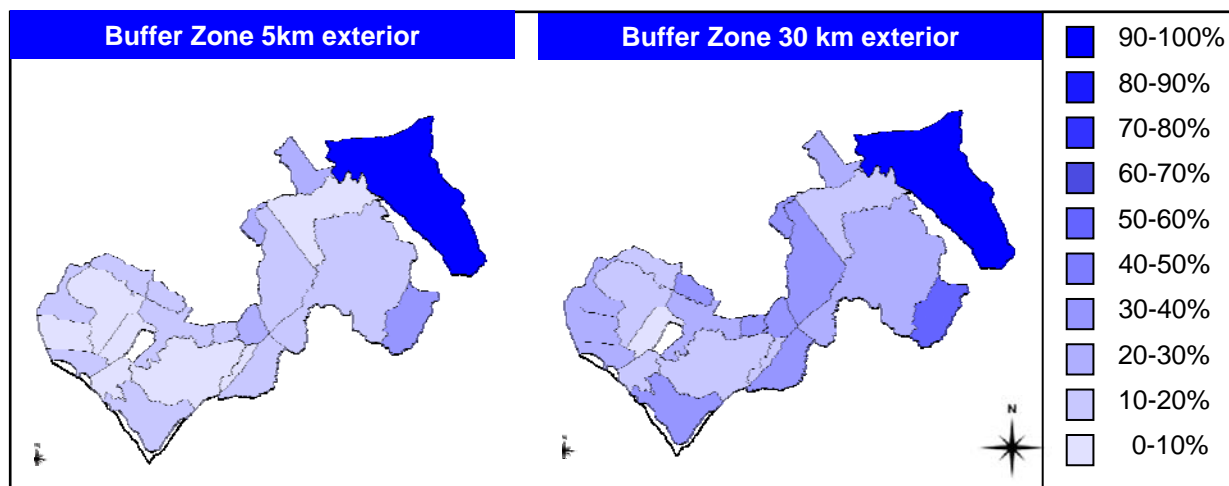
Fig. 4.15: Indicator of population pressure within a buffer zone of 5 km exterior (left) and 30 km exterior (right) to park borders in the year 2000. The indicator is based on The African Population Database (Nelson 2004). Color gradings give categories of threat, relative to highest value (i.e. Dosso in the north-east of the complex = 100%). For details see text

Chapter 5

Box 5.1: Statements used to calculate an attitude indicator of respondents

- It is important to protect the wild animals and plants, so that our children can exploit them in the future
- Those people that hunt without permit have to be punished
- The need of people and their livestock are more important than the protection of animals and plants
- Those animals that devastate the fields or prey on livestock have to be killed
- The tourists that come bring benefits to the local population
- The pasture and agricultural encroachment in the park have to be prevented, otherwise all the animals will disappear.
- Local people are not at all integrated in the decision-making concerning the protection of animals and plants in the park
- Local people should have the right to kill as many wild animals as they need for their nutrition
- The park has to be declassified so that the land can be used by the local population for their own purposes

Annex 5.1: Problem categories

Sociological (A)

Problems that either concern the interaction of actors/ actor groups, the institutional and organisational set-up, or society as a whole primarily focus on the rules and norms of living together. They are therefore classified as sociological problems. Conflicts may arise due to strict rule settings and socio-ecological interactions, e.g. resource shortages. However, the categories summarized as "sociological" emphasize secondary effects and outcomes of these adversities, like e.g. consequences of competition between user groups or conflicts with monitors of rule settings.

▪ **Conflict farmers-herders**

Being situated in a semi-arid transition zone, pastoral nomadism (transhumance) is an important and ecologically well suited form of cultivation in the region. However, due to growing populations of both, farmers and herders, there is also growing competition between these groups and land is becoming a scarce resource. The demand for cash crops, i.e. cotton, is exacerbating the problem. The unexploited land of the PAs with its productive meadows and fertile soils is therefore highly sought-after. In the vicinity of the PAs one of the main problems is that livestock of the transhumants (usually Peulh) is causing crop damage in the fields of the sedentary farmers. Although there are local and regional initiatives initiated by both, management authorities and user groups (like grazing areas and transhumance corridors), conflicts are ubiquitous and often violent.

This category includes the following items: *farmers do not respect the zoning within the buffer zone; the transhumance corridors are occupied by farmers; farmers burn their fields immediately after harvest; foraging of domestic animals in cultivated fields; conflicts between farmers and herders (general)*

▪ **Conflict rangers-villagers**

Rangers and their adjutants are monitors and enforcing powers of formal rule settings at the same time. Their organization is in most cases paramilitary and due to the absence of other regulatory mechanisms and organisations, their executive power in the field is very high. This opens the door to malpractices and corruption, and in some cases to local rule regimes that deviate from given formal frameworks. Low salaries, insufficient or missing equipment and personal coverage contribute to these adversities. On the other hand, due to their role as enforcing power of often restricting rule settings, conflicts with resource users are system-inherent and strict enforcement is sometimes perceived as abuse by locals. Often a lack of knowledge or understanding of formal rule settings is intensifying this perception and fuelling conflicts.

This category includes the following items: *conflicts with rangers; presence of poachers from other villages and resulting problems with rangers; rangers kill livestock in the park; rangers kill livestock in the buffer zone; the private rangers kill livestock in the buffer zone; the rangers chase our wives if they find them collecting firewood in the park; the rangers charge penalties from the herders; the rangers arrest people outside the park/ without any reason; the presence of rangers scares us; unjust actions by rangers; the rangers ask s.th for the exploitation of grass*

▪ **Institutional/ organisational**

The primary option for resource users to take action and actively participate in PA management operations and decision making processes is via the local village participatory body (vpb), i.e. either a committee or an association. If these vpbs are not working though, the individual has only limited power to lobby his/her personal interests in the interaction with private or state actors. Their activities hence may be perceived as arbitrary by local resource users, who neither have the possibility to influence the making of formal rule settings, nor the way of their implementation in the field. Often lack of information and its circulation form part of the problem.

This category includes the following items**:** *restricted access to PA; penalties for illegal pasture are much too high; tax for cultivable land has to be paid; tax for legal pasture is much too high; no power to take action; disutility of vpb; absence of aid by rangers; lack of information on exploitation of buffer zone; displacement; land reclamation by rangers; land reclamation for village hunting zone*

▪ **Societal**

The change of property regimes due to the establishment and management of PAs can have tremendous effects on informal rule settings and community structure. In some areas high immigration rates into PA vicinities have been reported due to incentives provided by integrated conservation and development projects. However, if these incentives are missing and people experience high levels of restriction and arbitrary power, the opposite may be the case. Due to high population growth rates, emigration often does not lower human pressure on natural resources. Migration moreover can degrade social capital and the adherence to local rules and norms (and associated social control). Establishing new rule settings and creating pro-PA initiatives is also more difficult in such settings.

This category includes the following items: *the park makes the young go away*

Socio-ecological (B)

Socio-ecological problems cover all sorts of problems and conflicts that deal with the interaction of resource users and their resources, respectively the ecological system. They are therefore more directly, more basically connected to PA establishment and management than social problems. These problems can result from users being cut off from their resources, resource degradation or local people experiencing the forces of nature without being able to take regulative action. The value of resources and ecosystem services to local resources can to some extent be derived from their statements about problems and limitations associated with the PA.

▪ **Human animal conflict**

Human-animal conflicts are a very widespread problem associated with PAs. Often high human population densities border directly to relatively intact and strong populations of wild animals. People in rural landscapes that heavily rely on the agricultural outputs they produce, can be severly hit by crop raiding elephants or hyenas killing their sheep, goats and cattle. If there is no

compensation scheme in place, be it based on traditional norms or newly introduced management tools, families might be threatened not only in their economic survival. As counter strategies local resource users usually are limited to preventive measures, e.g. the construction of shelters for livestock or the plantation of chilli around their fields, as killing of wild animals is not allowed. In severe cases, human-animal conflicts even result in human injuries or fatalities.

This category includes the following items: *presence of predators; hyenas; predators killing livestock; crop damage caused by elephants; crop damage caused by wild animals; crop damage caused by monkeys or warthogs; aggression of wild animals (elephant, buffalo)*

▪ **Limitations concerning agricultural/ pastoral activities**

The most important resource in rural areas is land, either used as farmland or pasture. Growing human populations in combination with ever growing demand of cash crops, e.g. cotton, on the world markets, often lead to high rates of conversion and make PAs resemble isolated islands in a degraded matrix. Preventing encroachment of fields and livestock in PAs and preserving spatial integrity is therefore one of the most important goals of PA management. Changes in property regimes due to PA establishment and management often lead to complicate realities in the field, as formal and informal rule settings melt to site-specific frameworks. Traditional property rights are often complicated and neglected by governmental authorities.

This category includes the following items: *interdiction of pasture; interdiction to cultivate in the PA; interdiction to burn trees in the fields; necessity to permanently guard livestock; corridors for livestock in the buffer zone are too small; the number of corridors for livestock is too small; lack of water in the corridors; lack of dams; lack of land; the park/ the buffer zone has diminished the area of cultivable land; the soil is poor; the corridors for livestock have diminished the area of cultivable land, the buffer zone is too small for everybody*

▪ **Limitations concerning natural resource exploitation**

Local resource users often use natural resources in various ways. For example they cut grass either for thatching their houses or feeding their livestock, they use medicinal plants as primary healthcare option, they collect fire wood to satisfy their energy needs, they hunt wild animals to supplement their diet. These resources are hence very important for diverse aspects of their livelihoods. Especially when resources in the vicinity are already degraded, the resources of the PA gain in importance. However, their exploitation is usually submitted to some form of restrictive rule settings. Often people have to make a demand at their vpb or local ranger unit and pay fees for a certain amount of harvesting units, which is perceived as a drawback of the PA.

This category includes the following items: *we have to pay for exploitation; restrictions to cut wood, restriction to exploit/ in PA (general); we do not have enough grass, interdiction to hunt*

▪ **Limitations concerning spiritual activities**

Restricted access to PAs often makes it difficult for local people to freely exercise their spiritual and religious beliefs if they are associated to natural monuments, animals or places in the PA. Usually these cultural values of the PA are used in a non-extractive manner and are based on longlasting traditions. However, PA officials report higher levels of illegal activities, e.g. poaching, if people enter the park freely. Local people

therefore often have to demand a permit or at least inform PA officials about their presence in the park.

This category includes the following items: *Problems in having access to fetishes in the PA*

Tab. 5.15: Items cited most often by respondents perceiving problems.

block	% of total items/ actor/ block	item
Arly (n=234)	50,9	destruction of fields by elephants (B)
	12,4	damage caused by other game animals (B)
	12,4	lack of cultivable land (B)
	11,1	limted availability of pasture (B)
	2,1	no benefits
W Burkina (n=108)	25,0	destruction of fields by elephants (B)
	23,1	limted availability of pasture (B)
	11,1	rangers ask for sth for exploitation of grass (A)
	10,2	lack of cultivable land (B)
	5,6	restrictions for resource use (B)
W Benin (n=206)	15,5	lack of territory (B)
	7,8	destruction of fields caused by wild animals (B)
	5,8	governmental rangers arrest people outside the protected area/ without any reason (A)
	5,8	presence of governmental rangers scarces us (A)
	5,3	unjust actions of governmental rangers (A)
Pendjari (n=124)	34,7	destruction of fields caused by wild animals (B)
	26,6	destruction of fields caused by elephants (B)
	20,2	presence of predators (B)
	5,6	lack of territory (B)
	2,4	restrictions concerning resource exploitation in PA (B)

Only positive answers, without "nothing" and "I do not know"; (A)= sociological; (B)= socio-ecological

Annex 5.2: Benefit categories

Resource exploitation (A)

Resource exploitation comprises both, agricultural/ pastoral exploitation as well as exploitation of natural resources. This is one of the most basic forms of benefit sharing as it softens exclusion that is usually associated with conservation/ PA aims. It allows local resource users to access those resources that are vital for subsistence and local market economy. Furthermore, these access rights are often seen as inherent traditional rights by local resource users, which were taken away by governmental authorities. Therefore incentives directly concerning resource exploitation often have practical as well as symbolic value to local resource users.

▪ **Agricultural/ pastoral exploitation**

Benefits resulting from agricultural/ pastoral exploitation are closely associated with the existence of some kind of buffer zone where rule settings allow restricted exploitation. In this case, management authorities often legalize land occupation in the interior of the PA in order to avoid conflicts borne by displacement. In general, these benefits are highly valued by most respondents citing them, as cultivable land and pasture are considered as resources of utmost importance. On the other hand, these benefits are associated with high negotiation/transaction costs, and hence are a potential source of conflict between different groups of resource users, or between resource users and governmental authorities (see "Problem" chapter).

This category includes the following items: *allocation of cultivable land in buffer zone; fertility of soils; pasture zone in buffer zone; proximity of good pasture (probably illegal); water supply for livestock*

▪ **Natural resource exploitation**

Natural resources include all kinds of resources that are not cultivated by man but exploited in an extractive manner. Depending on kind of resource, rule setting and PA, resource use is either not restricted and for free or subjected to regulations (including permit systems and sanctions in case of abuse). However, rule settings are often not clear to actors and rules in law might be different from rules in practice. Though a large number of respondents has access to natural resources in PAs, they are often regarded as being of minor importance, resp. not sufficient. The rate of illegal exploitation (including poaching) therefore is estimated high, however, can hardly be assessed quantitatively in research like ours.

This category includes the following items: *wood (fire wood and wood for construction, only dead wood); medicinal plants, wild fruits; grass/thatch; fish*

Monetary benefits (B)

In order to reduce dependence on unsustainable agriculture and natural resource use, management authorities try to establish new forms of alternative use that compensate local communities for exclusion from PA resources. Tourism often plays a major role in this sector, by connecting global interest and monetary potential with local needs. In the region, big and small game (trophy) hunting is a major source of revenue for PA management authorities. There are various mechanisms in place to redistribute income from tourism, projects or other sources to local communities. Often, local people do not know these mechanisms in detail, but perceive

certain monetary benefits either on community or on individual level. To be an effective tool of conservation, however, there has to be awareness that these benefits that support local development are derived from PA management activities. Being implemented like this, monetary benefits can be strong incentives to enhance rule compliance and support sustainable forms of exploitation.

There are three subcategories to the main category of monetary benefits: Trade, Direct payments, and Employment

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▪ **Trade**

Trade in our study did not include potential benefits from growing cash crops like cotton. In fact, these were only cited indirectly by respondents as agricultural benefits. Trade here means income via (legal) trade of natural products. In almost all cases, this was associated with trade of bush meat as a mechanism of generating money for the community. The bush meat (in this case a by-product of trophy hunting) is given to village associations/ committees by hunting operators and sold to villagers (see below). In some areas respondents acknowledged this mechanism explicitly as win-win strategy for themselves (reduced prices, legal access) and for the community as a whole (capital to finance infrastructure) at the same time.

This category includes the following items*: money for village bank account via trade of bush meat; trade of natural products (straw mats)*

▪ **Direct payments**

Direct payments describe any kind of payment that is given to local communities by management authorities. In all cases, legal frameworks exist that determine the key of benefit sharing between private and governmental actors as well as financial participation of local communities. However, operational mechanisms are complex and often non-transparent, so that resource users do not have exact knowledge about them. We included in this category payments resulting from trophy hunting as well as from small game hunting. Though village hunting zones are to a certain degree managed by local committees/associations, they rely on professional operators to carry out hunting. As a result, they often do not distinguish between these two different sources of income (Burkina Faso). Funds are usually managed by village committees/ associations on the local level and supervised by some higher level authority. They are mostly invested in community infrastructure.

This category includes the following items: *direct money/ income for the village; income from trophy hunt, loans given by village committee/ association, money via village hunting zone, money via tourism*

▪ **Employment**

In most integrated conservation and development (ICDP) approaches, the number of jobs created in operational PA management or alternative income activities serve as indicators of success. Development issues are directly linked to conservation measures and people earning money in this sector are supposed to act as multipliers of awareness and positive attitude towards conservation. In most villages indeed, PA management authorities (private, governmental or para-public) represent the only employers. However, we found big differences between different management approaches, and a quite high degree of unpaid (in monetary terms) services delivered to authorities. There are also differences between PAs with regard to

the relation of people citing employment as a benefit and those that actually have been employed themselves.

This category includes the following items: *jobs; money earned for surveillance, money for the family via employees*

Material benefits (C)

Material and monetary benefits are closely linked. However, monetary benefits describe real cash flows reaching communities or individuals, whereas material benefits result either from infrastructure that is provided, or goods that are distributed by some kind of authority. Like monetary benefits they are thought to support local development e.g. by promoting education, and in the end lead to more positive attitudes towards PAs and their management authorities. Infrastructure is mostly perceived as a benefit on community level, whereas goods represent benefits on the individual/household level.

▪ **Infrastructure**

In fact, most direct payments are invested into public infrastructure, e.g. pumps, schools or health centres. Some PA management approaches, however, try to minimise direct payments in order to avoid abuse and conflict on the level of village committees/ associations. They instead directly invest the money (or parts of it) foreseen as direct payments in community infrastructure, driven by demands of the respective communities. Often investments in these infrastructures are shared by several parties, like private concessionaires, projects, village committees/ associations or public organisations. On resource user level, therefore it is often unclear, whether the infrastructure in question is provided due to PA management initiatives or not, and who is really giving funds for it.

This category includes the following items: *infrastructure (general); school; school furniture; accommodation for teachers/pupils; health centre; maternity; storage; construction of pump; maintenance of pump*

▪ **Goods**

As "good" we define any material benefit that is usually distributed on individual level. This is the most basic form of reciprocal interaction. It is therefore used to ensure loyalty and cooperation, and often misused to influence certain individuals in key positions. Material benefits are though given in turn for non-material benefits like rule compliance, prestige, access rights or to stimulate trust and negotiation processes. This holds true for all directions of interaction - horizontal, top-down as well as bottom-up. The good that was most often mentioned by respondents of our survey was bush meat that was given to them by authorities (see above).

This category includes the following items*: bush meat; meat for ceremonies; work material given by project; presents from concessionaire; food aid; donky received from cotton bio (project); diverse benefits resulting from tourism; presents from white tourists*

Institutional/ organisational benefits (D)

Institutional/ organisational benefits form the most abstract group of benefits. They include any activity that supports information flow between actors/ groups of actors or that enhances institutional/organisational capacity on the local level. Their nature as benefit to local resource users though is rather indirect (mediating other benefits). Hence, they are often only acknowledged by people directly involved in village committees/ associations that possess a high degree of information influx. Generally, communication and transfer of information are key processes of effective organisational interaction and often decide on success or failure of any management activity. Consequently, there should be a higher degree of perception of institutional/ organisational benefits by local resource users if village committees/ association are in place that are well embedded in social structure and fulfil their role as cut points between local population and management authorities.

- **Informational**

There are two different classes of information that represent a benefit to local resource users. One comprises a large scope of information concerning practical advices and formations on sustainable resource exploitation (cutting of trees, apiculture, etc.) or alternative ways of income generation (formation on soap production etc.). The other focuses on actual rule settings and laws that have to be followed in order to avoid conflict with authorities. The type of information mentioned first is usually mediated by some kind of NGO project, whereas the second type of information is often given by governmental actors themselves (depending on PA).

This category includes the following items*: "advices"; training & formation; formations on sustainable use of trees; formation on formal laws; formation on apiculture; dialogue between authorities and villagers*

- **Organisational**

Effective organisational and institutional set-up on the local level is widely seen as a prerequisite for successful participation of local population. Building on social capital and traditional structures seems to be a promising approach to build a bridge between governmental/ private actors and local resource users. However, if there is a diverse context of different life strategies, ethnic groups and immigration patterns, it might be necessary to find new ways of integrating these partners. Any benefit that enhances local organisational capacity, either by building of institutions or organisations, or by mediating contacts (e.g. to projects) is classified in this category.

This category includes the following items: *creation of village committee; creation of village hunting zone; bank account at disponibility of village; access to micro-credits; access to projects; installation of AVIGREF; reduction of conflicts between farmers and herders due to existence of BZ*

Non-material, divers

There were some items that where difficult to classify according to the scheme presented here. As they were cited very rarely, we put them into a new category of "non-material, diverse" benefits. The one that was mentioned most often was "opportunity to see wild animals". This might be expression of some ethical or spiritual value assigned to these animals, or just being used as gap fillers. According to other answers given by the same respondents, we tend to the latter. Research has shown that local residents are usually not associated with the perception of

intrinsic conservation benefits (Balmford % Whitten 2003, Spiteri & Nepal 2008). However, we do not want to give a final judgement on these statements and leave it to the reader for interpretation.

This category includes the following items: *nature conservation; you can see wild animals; knowledge of wild animals and plants; no more problems with traps of poachers; ceremonies organised by AVIGREF*

Tab. 5.16: The five most often cited benefit items in each block ("top 5")

block	% of total items/ actor/ block	item
Arly (n=408)	38,2	*grass (A)*
	16,9	*bush meat (C)*
	14,0	*wood (A)*
	6,6	*jobs (B)*
	4,7	*money via meat trade (B)*
W Burkina (n=193)	25,9	*grass (A)*
	14,0	*bush meat (C)*
	13,5	*jobs (B)*
	8,8	*wood (A)*
	6,2	*money via village hunting zone (B)*
W Benin (n=197)	31,0	*lot of cultivable land in BZ (A)*
	17,3	*pasture zone in BZ (A)*
	11,2	*productivity of soils in BZ (A)*
	7,1	*construction of school (C)*
	6,1	*(fire) wood (A)*
Pendjari (n=432)	24,8	*bush meat (C)*
	14,9	*jobs (B)*
	12,4	*money for village bank account by selling of bush meat (B)*
	8,9	*thatch/grass (A)*
	8,3	*fish (A)*

Only positive answers, without "nothing" and "I do not know"; (A)= resource exploitation; (B)= monetary; (C)= material; (D)= institutional/ organisational
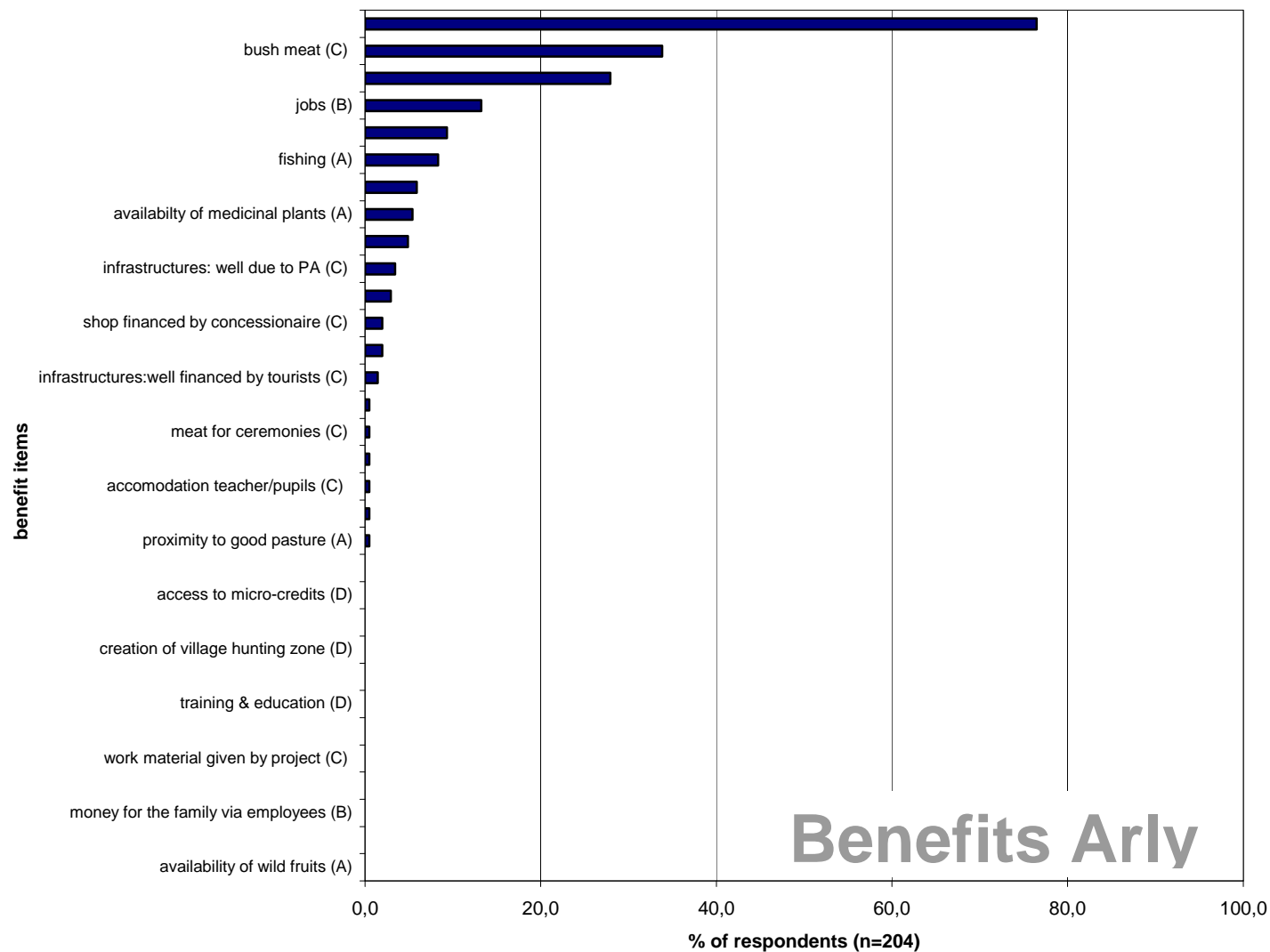
Fig. 5.8: Benefit-items ordered by frequency in Arly

Fig. 5.9: Benefit items ordered by frequency in W Burkina

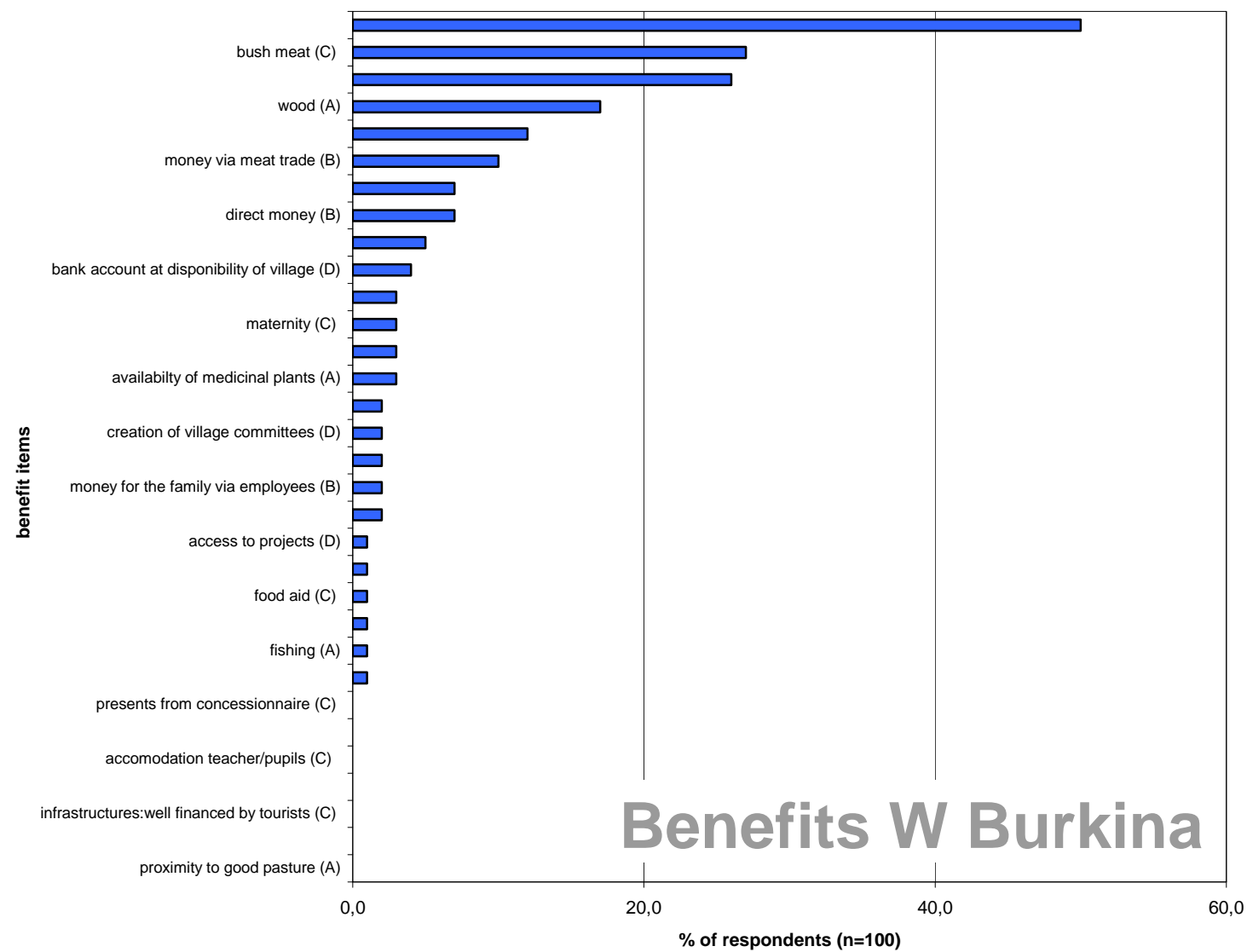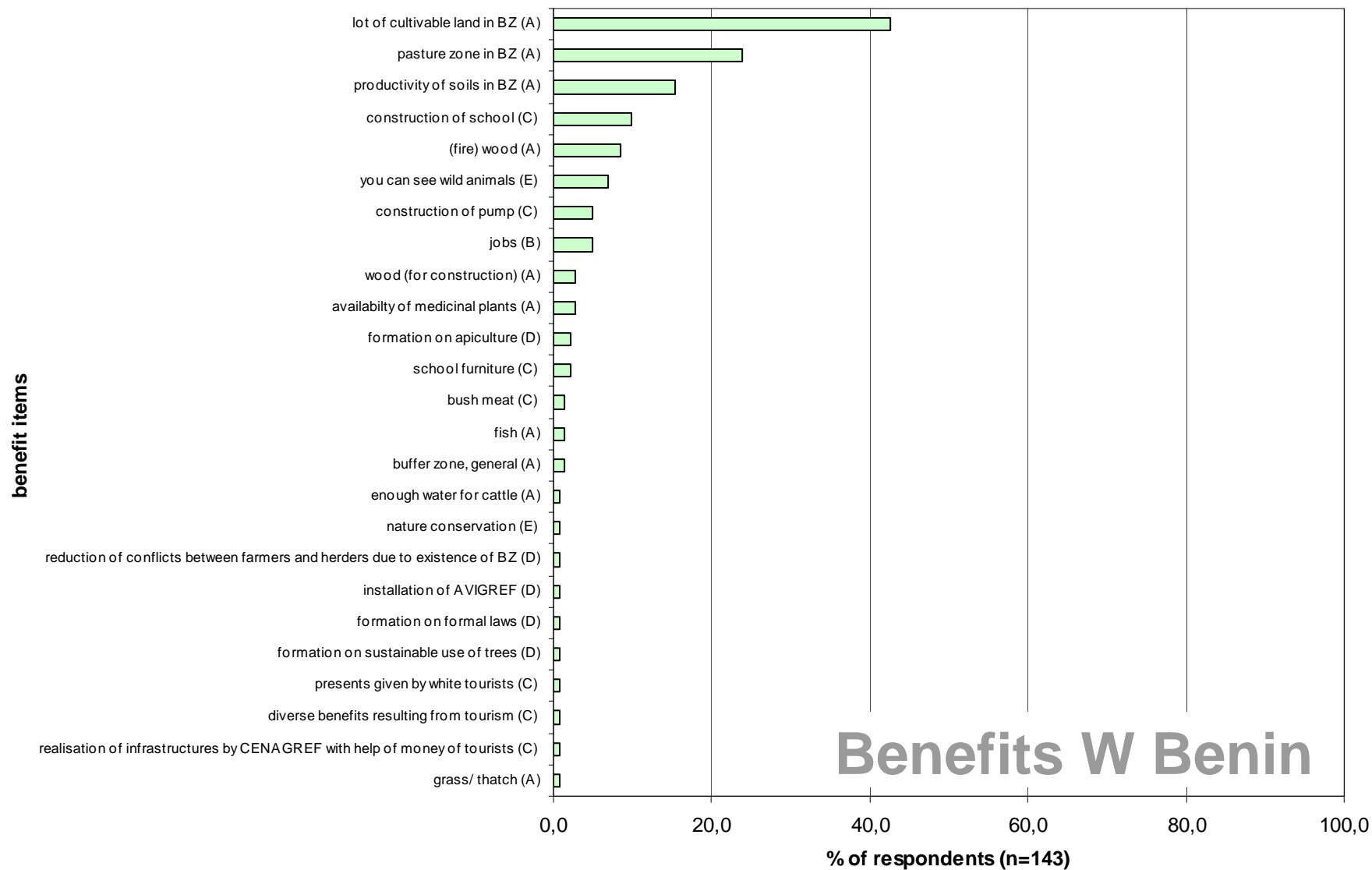**Fig. 5.10:** Benefit items ordered by frequency in W Benin

Fig. 5.11: Benefit items ordered by frequency in Pendjari
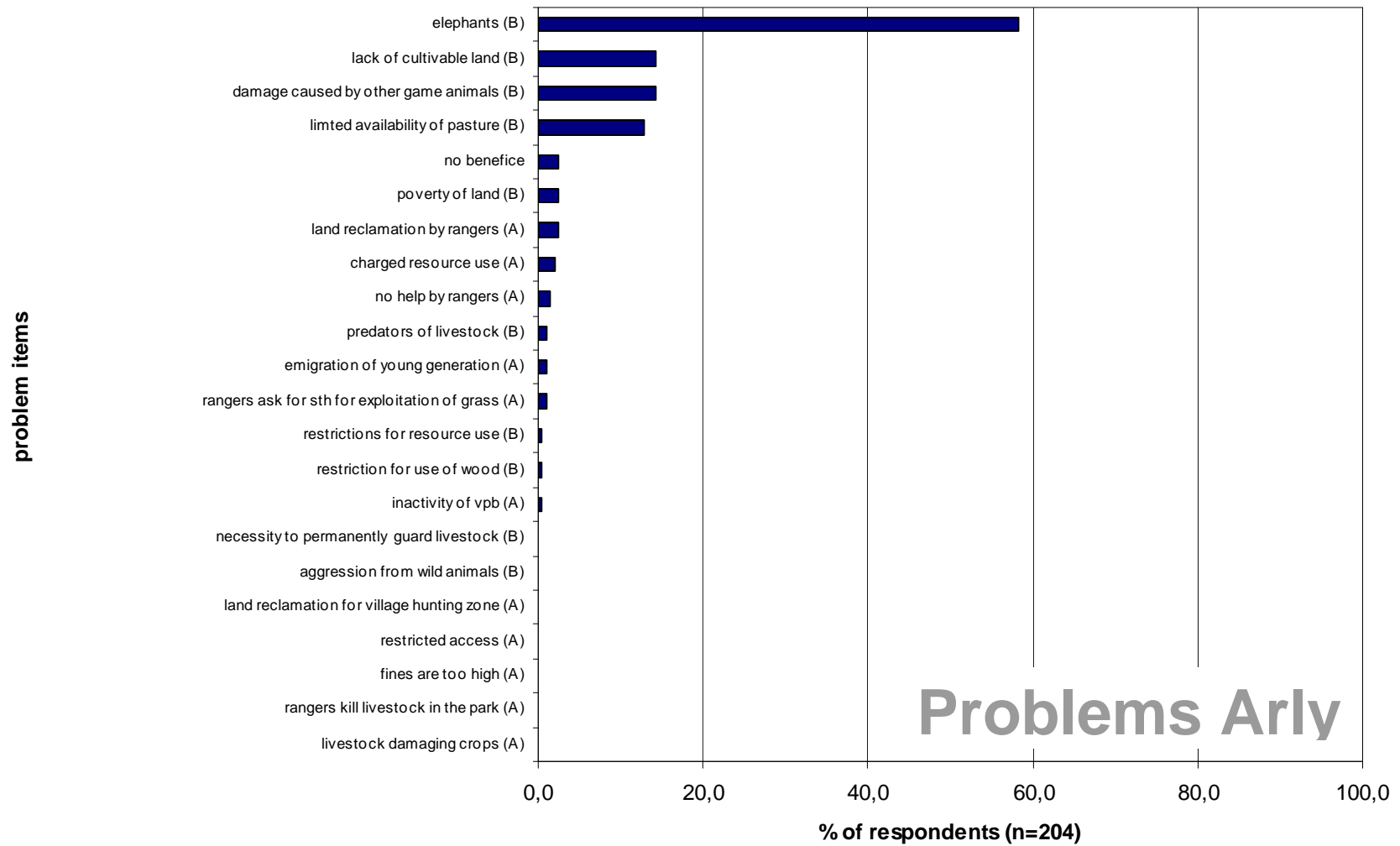
Fig. 5.12: Problem items ordered by frequency in Arly

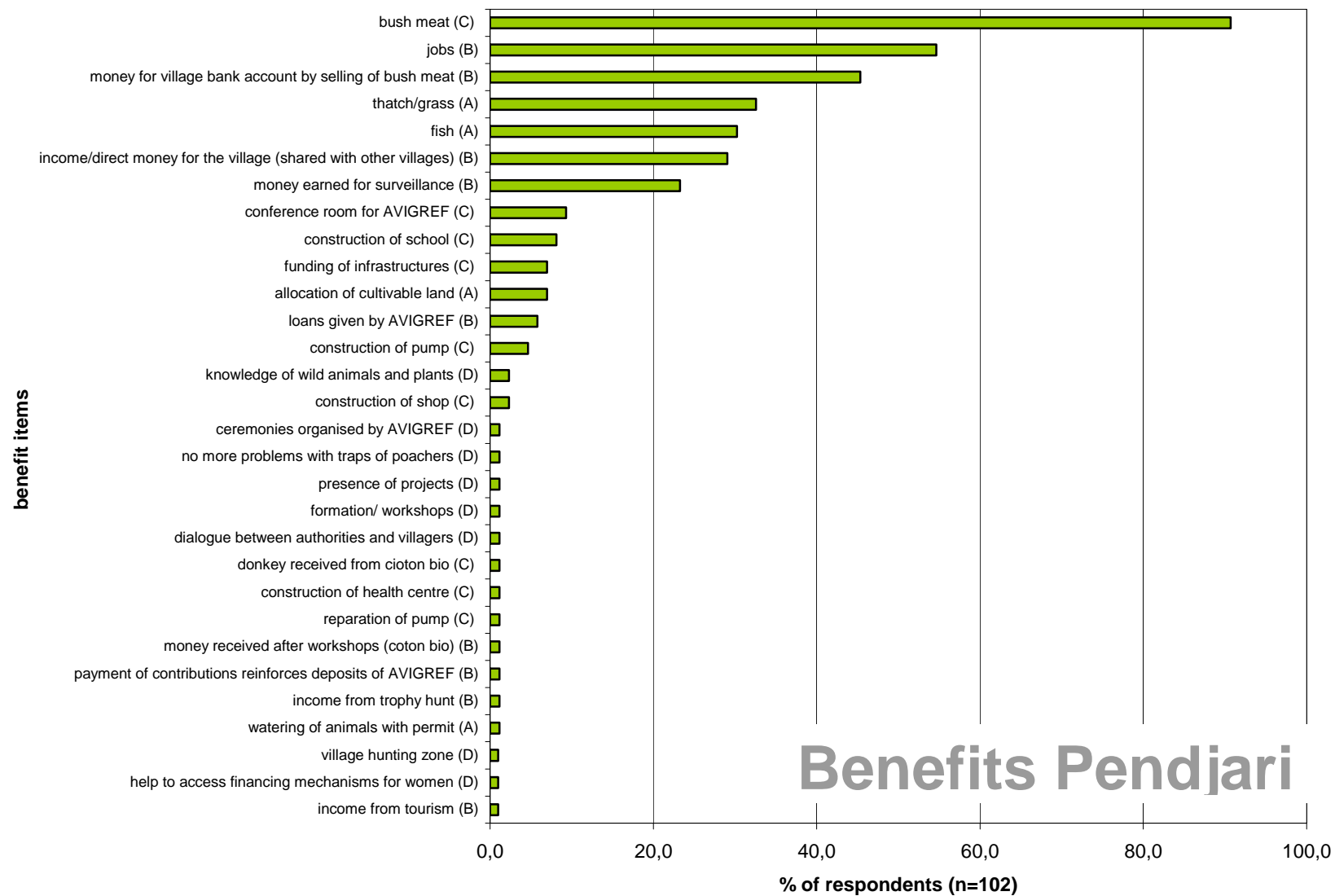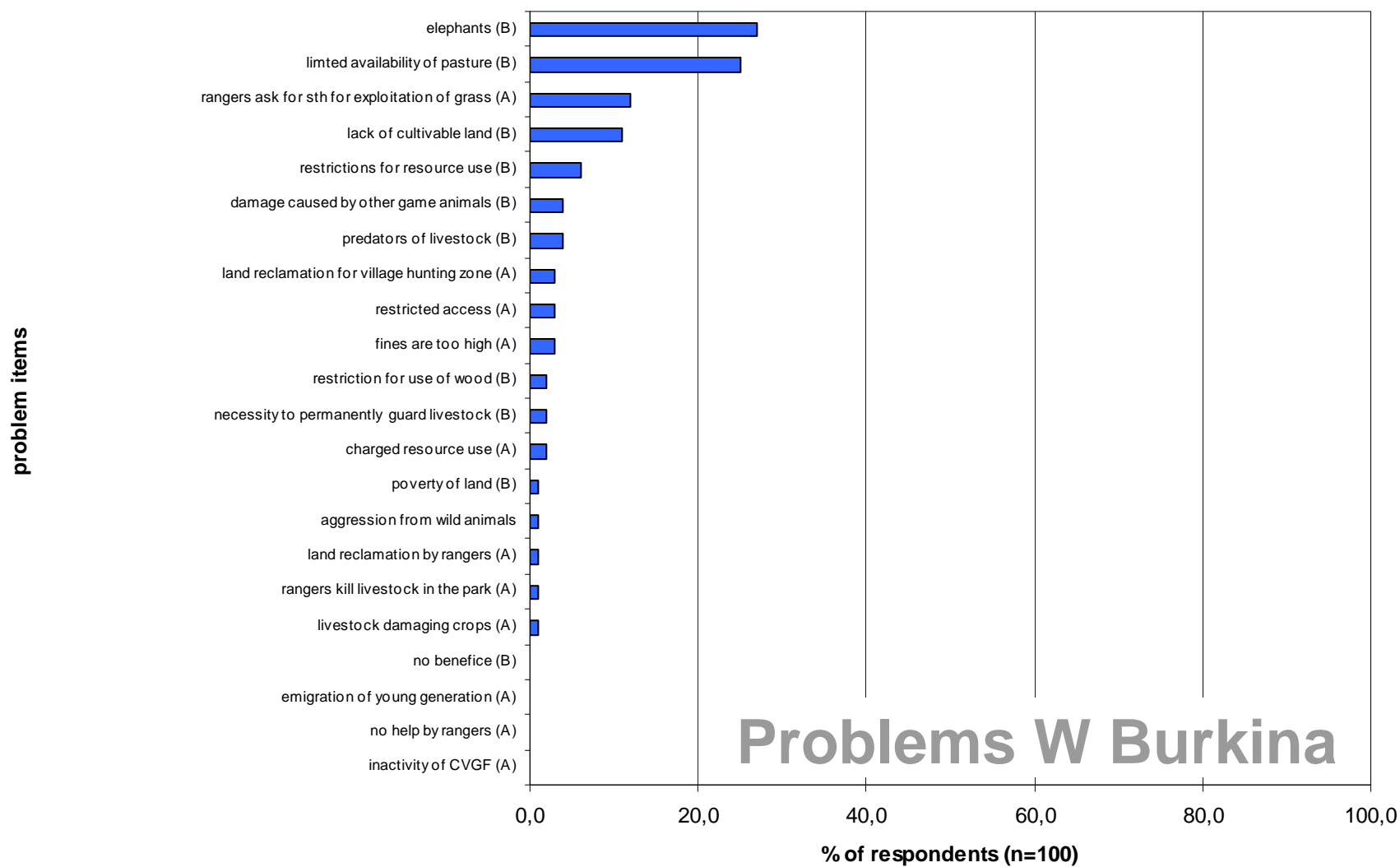**Fig. 5.13:** Problem-items ordered by frequency in W Burkina
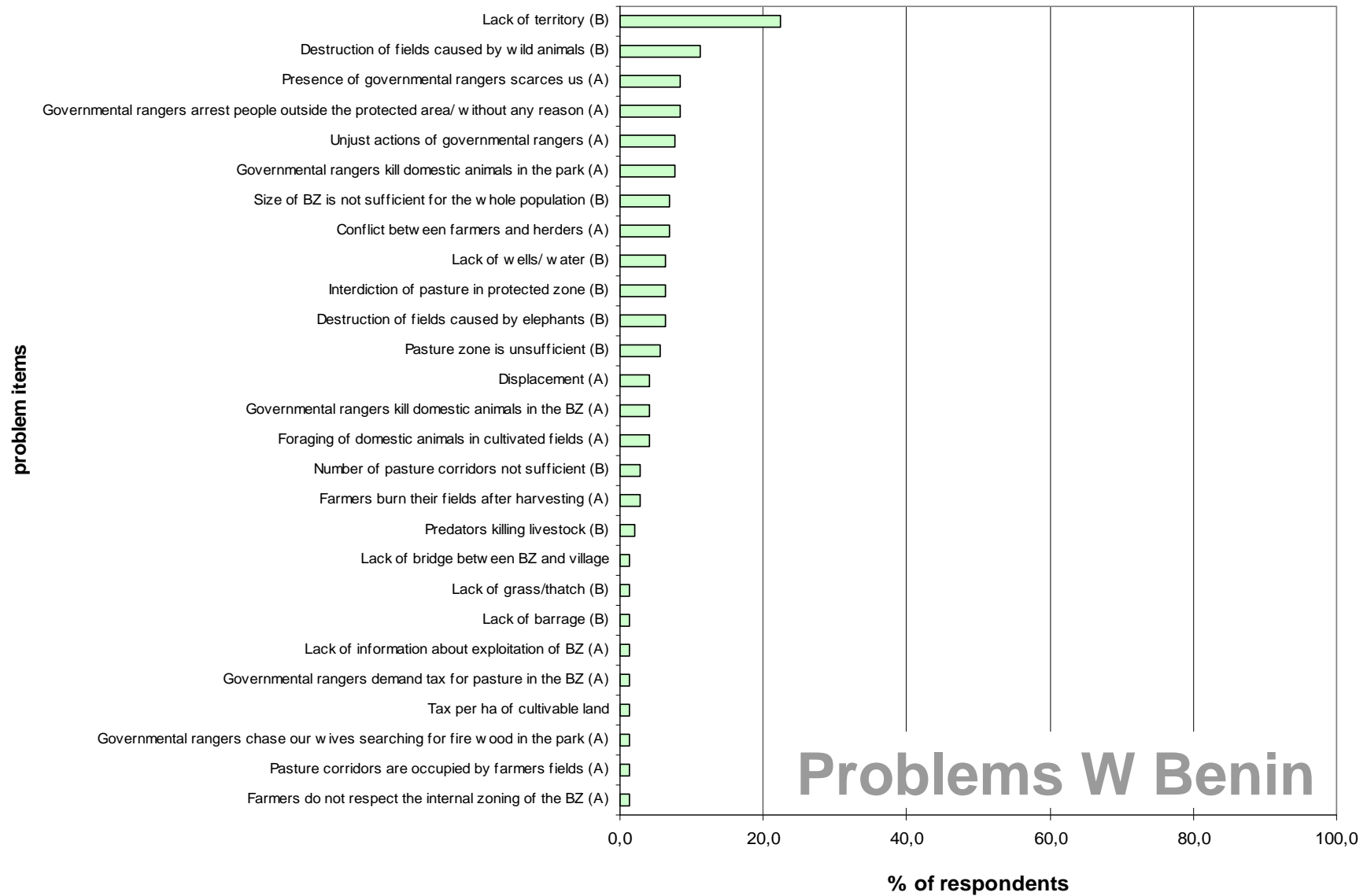
Fig. 5.14: Problem-items ordered by frequency in W Benin
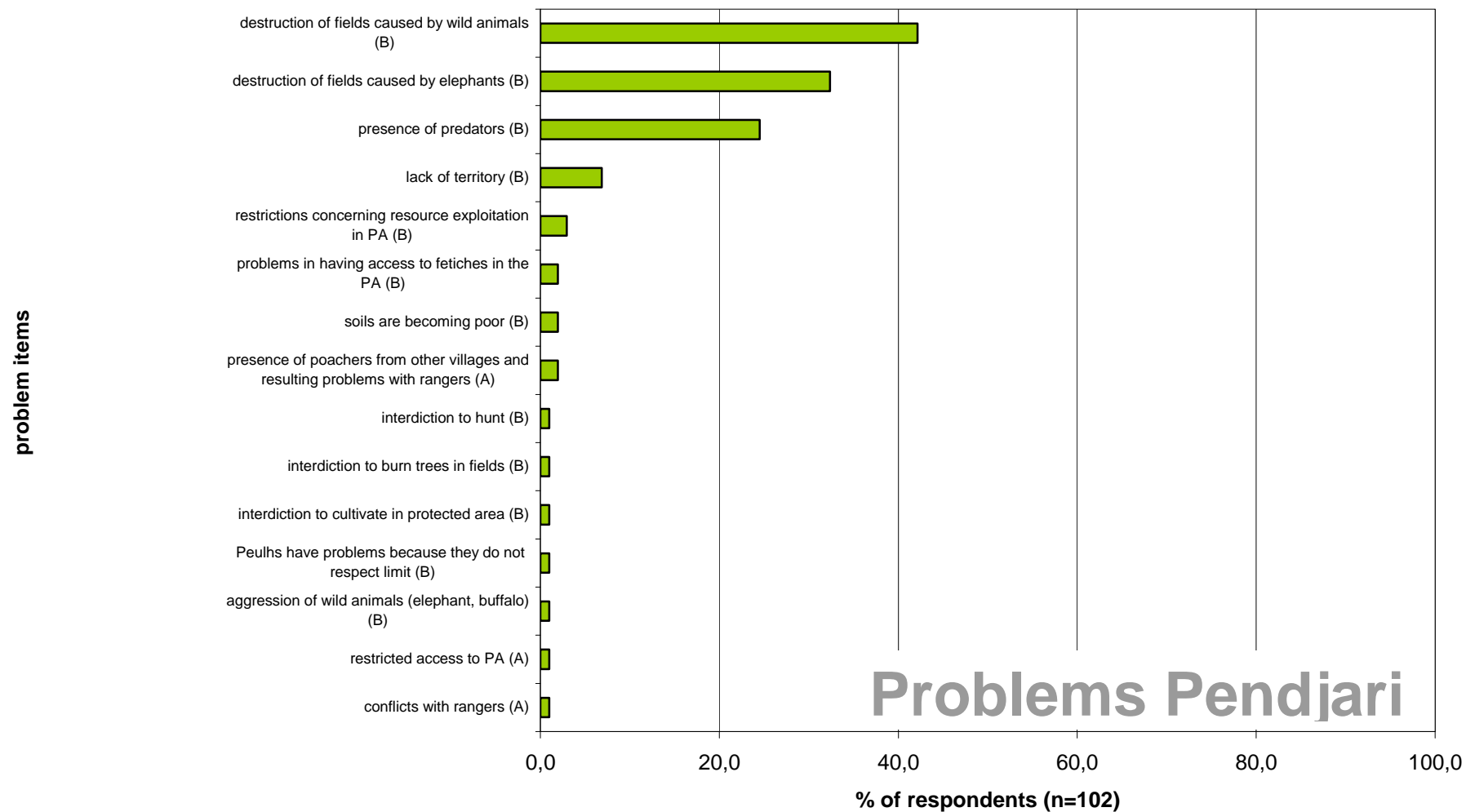
Fig. 5.15: Problem-items ordered by frequency in Pendjari

Annex 5.3: Citations benefits

"Which benefits do you or your community have resulting from the Protected Area?"

[Note: All citations were translated from some local language to French first, and afterwards into English. In this last step, some of the citations have been reprocessed for better understanding. According to our judgement, there has been no change of meaning in any case.]

<div align="right">Interview 88, Block Arly, Burkina Faso</div>

"Nothing. On the contrary, the elephants are the ones who are privileged."

<div align="right">Interview 217, Block W, Burkina Faso</div>

"In my opinion, we do not benefit from anything except the grass. The park deprives us of a lot of things."

<div align="right">Interview 35, Block Arly, Burkina Faso</div>

"I never go there. I even fear the rangers, and I do not get anything."

<div align="right">Interview 38, Block Arly, Burkina Faso</div>

"We fish there, but illegally."

<div align="right">Interview 163, Block Arly, Burkina Faso</div>

"I do not profit in any way. In order to avoid problems, I buy everything here, grass, wood, and so on"

<div align="right">Interview 2, Block Arly, Burkina Faso</div>

"(…). I get access to grass. Furthermore our wives enter the park and steal fire wood for cooking."

<div align="right">Interview 232, Block W, Burkina Faso</div>

"I do not know, except the grass. And we give chickens in order to receive permits."

<div align="right">Interview 448, Block Pendjari, Benin</div>

"(…). And we have the grass due to a demand we pass via the AVIGREF Union."

<div align="right">Interview 115, Block Arly Burkina Faso</div>

"Everybody who is asking for grass gets it for free"

<div align="right">Interview 364, Block W, Benin</div>

"We are cultivating our parcels in the buffer zone and get high yields. We also take our cattle [there] for grassing, and they are in a good shape."

<div align="right">Interview 367, Block W, Benin</div>

"Our benefit is that CENAGREF has helped us to avoid conflicts between farmers and herders by giving each group a specific zone in the buffer zone. Being herder myself, I take my cattle there."

<div align="right">Interview 463, Block Pendjari, Benin</div>

"We get grass, and after posing a demand, we can water our animals in the park"

<div align="right">Interview 152, Block Arly, Burkina Faso</div>

"I sometimes gain (…) medicinal plants. Because it is only in the park that we can find it. In the village territory we have cut everything."

"If I need grass or dead wood, I have to go to the rangers and ask for a permit. And if the bush meat is sent, and I have some money, I buy it."

"(…).And sometimes, if there is some ceremony, we ask the rangers for permission and they accompany us for hunting some game"

"We gain thatch for our huts and enclosure, and dead wood as well. And if there is bush meat, everybody can have. And we have a well thanks to tourist who came because of the protected area."

"We can say that we have benefits, because after the tourists have visited our country, CENAGREF takes their money to help us by constructing different infrastructures in the village. (…)"

"The vegetation is being protected, and there is eco-tourism which brings a lot of advantages to the population."

"Because of the park, CENAGREF has given 150000 FCA for the construction of our school. We also benefited from the distribution of parcels of land in the buffer zone and the fertility of the soils there. Furthermore, I know all the wild animals."

"(…) and also we received some financial support from the concessionaire for the construction of a storage facility."

"We received school furniture for our children. And they promised a lot of things.

"I think everything we have here in the village – our well, our school, the village committee and the village hunting zone – is due to the protected area. (…)"

"(…). My brother worked as assistant ranger. In the past he earned money, but now since the ECOPAS project has been terminated, he gets nothing."

"(…). Due to the park, I am assistant ranger and earn at least 10000 CFA per month given by CENAGREF. This helps me to satisfy the needs of my familiy."

"I am retailer of bush meat and earn 10000 CFA per month"

"Jobs in the surveillance of the park, payments that are shared by all villages next to the park, and the bush meat that we can buy."

"(…). I received formation on apiculture by CENAGREF."

"Thanks to AVIGREF we have a pump for drinking water in the village. The village has zones for cultivating, for collecting fire wood and for pasture. I received some training on official laws and rules that are implemented in the case of infraction. (…)"

"(…). The membership fees of all the members of AVIGREF strengthen our bank account. (…)."

"Due to the park there are projects that come to develop our village. (…)"

"Nowadays there is a dialogue between the authorities and us. Before that, we had problems with the rangers. But today this problem does not exist anymore, because we are integrated into the management of the park."

"Due to the proximity of the protected area, a conference room for our village committee is being built. We receive money from the authorities, which is being put on our village bank account. We also receive bush meat that is being sold. This money reinforces our bank account as well. AVIGREF organises ceremonies, during which I can take some food for my family."

"A lot. At first, there is bush meat that we receive for free, money that we get for small game hunting in our village hunting area, the lease costs from the concessionaire that is paid at the end of each hunting season, thatch for our huts, and some of our brothers work for the concessionaire or the rangers. All this are advantages for the village. I myself gain bush meat to buy and thatch for my huts."

Chapter 6

Tab. 6.9: Activity items (i.e. without "I do not know" and "no service") that were cited most often by respondents (top 3).

block	% of total items/ actor/ block	item
rangers		
Arly (n=342)	19.9	surveillance & protection of park and its animals
	18.1	authorizes/ enables resource exploitation (general)
	6.1	enforce penalties
W Burkina (n=176)	15.9	surveillance & protection of park and its animals
	9.7	enforce penalties
	6.3	demand s.th for issuing permits
W Benin (n=277)	13.7	surveillance & protection of park and its animals
	9.7	arrest people outside PA/ without any reason
	8.3	kill livestock (in the park)
Pendjari (n=119)	24.4	surveillance & protection of park and its animals
	11.8	prevent poaching
	8.4	make surveillance with villagers
governmental service		
Arly (n=225)	20.0	provides trees for reforestation
	8.4	gives advices on bad practices and their consequences
	2.2	send rangers
W Burkina (n=109)	18.3	provides trees for reforestation
	6.4	gives advices on bad practices and their consequences
	1.8	make unfulfilled promises
W Benin (n=204)	11.3	construction/ financing of schools
	6.4	organise delimitation of BZ (*buffer zone*)
	6.4	construction of pump
Pendjari (n=147)	7.5	sensitizes to protection and importance of the park
	6.8	maintenance and reparation of pump
	6.1	construction/ financing of assembly hall
Vpb		
Arly (n=457)	15.3	prevents/ fight bush fires in ZOVIC (*village hunting zone*)
	14.0	fights illegal woodcutting in ZOVIC
	11.2	sells bush meat
W Burkina (n=166)	8.4	circulation of information
	5.4	prevents/ fights bush fires in the ZOVIC
	5.4	sells bush meat
W Benin (n=219)	10.0	gives advices on bad practices and their consequences
	5.5	gives information on law application
	5.0	plays role of mediator between authorities and villagers
Pendjari (n=325)	17.2	offers job opportunities
	12.0	sensitizes villagers to the formal rules
	10.8	sells bush meat
vbp UNION		

W Benin (n=155)	5.2	does the same work as AVIGREF village
	5.2	gives advices on bad practices and their consequences
	4.5	coordinates/ supervises activities of AVIGREF village
Pendjari (n= 155)	21.9	created AVIGREF
	8.4	sensitizes villagers to the formal rules
	7.7	makes formations with AVIGREF
concessionaires		
Arly (n= 263)	22.0	distributes bush meat
	4.9	makes hunters come
	4.5	construction/ financing of infrastructure
W Burkina (n= 119)	13.4	distributes bush meat
	5.0	procures clients for village hunting zone
	4.2	offers job opportunities
W Benin (n= 158)	5.1	distributes gifts for pupils (pencils. etc.)
	2.5	financed school furniture
	1.9	his agents maltreat us
Pendjari (n= 140)	55.0	provides access to bush meat
	8.6	arrests poachers
	7.9	makes hunters come
projects		
Arly (n=26)	30.8	provides trees for reforestation
	23.1	gives advices on bad practices and their consequences
	3.8	builds and maintains roads in the ZOVIC
W Burkina (n=129)	8.5	offers job opportunities
	7.8	offers formations
	4.7	gives advices on bad practices and their consequences
W Benin (n=143)	-	-
Pendjari (n=151)	19.9	introduced organic cotton project
	11.9	maintenance and repair of pumps
	10.6	construction/ financing of school

Only "action items" displayed; % of total includes all items given (n in brackets)

Chapter 7
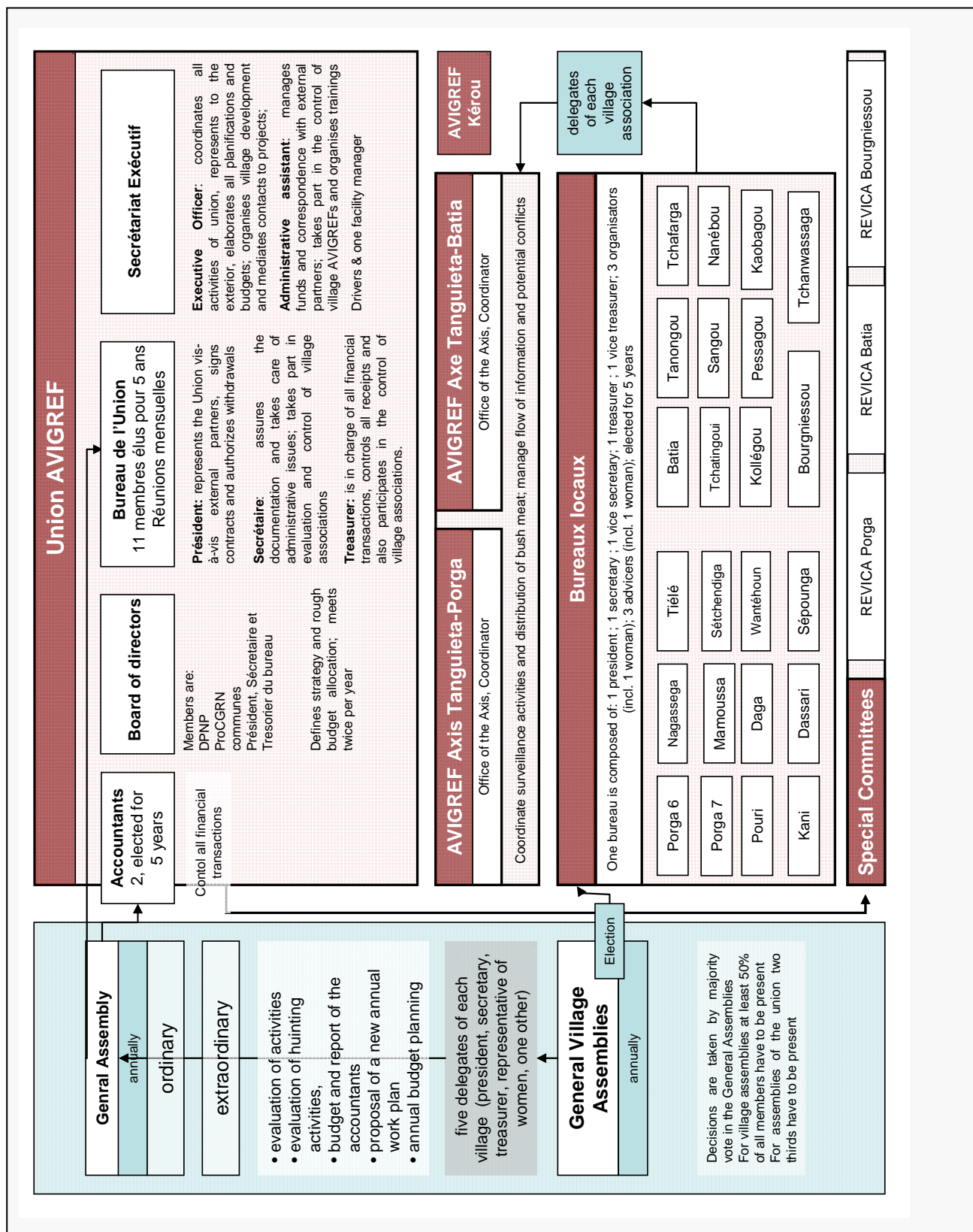
Fig. 7.4: The organisational structure of AVIGREF in the Pendjari region at the time of our study (own illustration based on bylaws of AVIGREF Pendjari)

Annex 7.1: Motivation: benefits of taking responsibility

As described above, being active member of a vpb and participating in associated action arenas can be an advantage- or not. Various factors influence personal payoff functions, with material benefits and social prestige being among the most obvious ones. Necessarily these functions need to be positive in order to guarantee a high level of motivation of members and long-term vpb functioning. However, if uncontrolled, there is also the risk of abuse and corruption associated to these motivating factors.

W Burkina Faso: Motivation: benefits of taking responsibility

Being member of a CVGF offered various personal benefits for the adherent, at least as long as the ECOPAS existed. All members of the CVGFs we interviewed had been employed several times for road maintenance or surveillance tasks and were paid by the project. They also received a per diem when taking part in trainings offered by the projects. Two of the CVGFs therefore introduced new boundary rules for participating in their committees and asked new members to pay an adherence fee (ca. 2.000 CFA). CVGF members also held decision making power in village internal action arenas, which probably were associated to social prestige. They e.g. selected co-workers for the jobs offered by the project or were in charge of distributing bush meat. For these arenas there were often no formal and transparent rules and processes established, i.e. CVGFs were able to use their own selection criteria for co-workers or potentially use the distribution of bush meat as an instrument to influence others according to their own interests. Furthermore, even if poorly established, their participation in action arenas with governmental actors potentially assured CVGF members the power to betray any resource user on rule infraction to rangers.

Arly: Motivation: benefits of taking responsibility

See W Burkina Faso

Unfortunately our interviews did not reveal much about the personal motivation of CVGF members to fulfil their positions. Nevertheless, we assume the same reasons as in the W region: material benefits and social prestige. Though there was actually no project that offered job opportunities, many CVGF members had made positive experiences with projects in the past. Even if not very much pronounced in many areas, they enjoyed the privilege of being closer to governmental officials and also private actors, so that they might gain also smaller benefits from time to time.

Social prestige might even be higher than in the W Burkina area, as CVGF members showed a higher degree of self-confidence and actively struggled for their rights in respective arenas.

Pendjari: Motivation: benefits of taking responsibility

Incentives for becoming ordinary member of AVIGREF have been described above. Benefits also accrue for the whole communites in the form of public infrastructure. Despite its high degree of organisation, incentive structures for members of the bureaus

were mainly based on (potentially) social prestige and room for manoeuvre in the distribution of bush meat and jobs like in other areas - several interviewees of our household survey accused their bureaus of nepotism. According to internal evaluations, in some villages there were also quite high amounts of money vanishing from AVIGREF accounts.

Several AVIGREFs therefore advocated the introduction of some kind of remuneration for the bureaus on village level and higher compensation payments when attending meetings and formations. As systems of rule adaptation and control improved over time, it also became more difficult for members of the bureau to e.g. abuse funds for private profit. One vpb complained:" The former president of AVIGREF village gained much more." (vpb 25)

W Benin: Motivation: benefits of taking responsibility

As there was little turnover of the bureau personnel and villagers were not well informed about the tasks of AVIGREF when they chose their bureaus, neither villagers nor the ones that became members of the bureaus might have been aware of the difficulties associated with the establishment of AVIGREF. Many of our interview partners themselves showed little interest in self-mobilisation or identification with the rationale of AVIGREF and the protection of the park, and often answered rather as peasants than according to their role as AVIGREF members. In the beginning project staff and authorities raised hopes of manifold benefits that villagers would receive, and so motivated people. One AVIGREF stated that their main motivation to take over responsibility was the establishment of the BZ and a concomitant enlargement of their village territory that could legally be used for exploitation (vpb 16). However, after some time it became obvious that there were only little positive incentives on communal level and de facto no (legal) incentives on the individual level for bureau members. Instead conflicts were ubiquitous.

"Why are you (not) member of AVIGREF?"
Park W Benin

Pros

- I was chosen
- I want to serve my village
- to develop our village
- to integrate the villagers into PA management
- I want to help my peulh brothers
- I want to help the rangers
- I want to help the villagers to understand the rules
- being a good example
- to conserve the PA
- to protect the villagers from arbitrary acts of rangers
- to protect the villagers from wild animals
- I want to benefit of some land in the buffer zone
- I was at school and do speak french

Cons

- I was not chosen by village
- I do not want
- other family member involved
- I have other obligations
- I am too old
- I was absent when committee was chosen
- I do not stay in one place
- I am too young
- Peuhl are not considered
- I do not have the time
- AVIGREF of our village is not functioning
- I do not have any mean of transport
- AVIGREF was already formed when I arrived
- I do not want to have any problems
- cooperation between rangers and peulh does not work
- it is too dangerous
- I am an ancient poacher
- other Peulhs are members
- people consider me to be a stranger

0,0   20,0   40,0

% of answers given

Pros

Cons

Fig. 7.5: Reasons for joining or not a vpb in the two Blocks of Benin

Tab. 7.1: Number of vpb members among interviewees and distribution of positive and begative answers considering their motivation

	Number of interviewees being member of association (relative)	Number of pro-items		Number of cons-items	
		absolute	relative	absolute	relative
Park W Benin	22,4	30	21,9	107	78,1
Pendjari	74,5	74	77,9	21	22,1

Annex 7.2: Interactions of vpb: with researchers

- **Researchers**

W Burkina Faso

Visits of researchers that interact with CVGFs in the region were rare. Some come to make ecological surveys, others to conduct socio-economic research. In general there were no conflicts, however, CVGFs did not expect anything as a result of their visits: "They only take information, they never give back" (vpb 15). Some even expressed reservations about their coming, and voiced clear expectations: "Some pay, they are welcome". Researchers hence do not play any role in action arenas on this level.

Arly

Like in the W area, researchers did not play any role for CVGFs. Most villages said not to be in contact with any scientists. One committee complained that they never received any results:"Researchers come, take their data and then they leave." (vpb 5)

Pendjari

All villages reported to be frequently visited by researchers. During the whole course of our study, we felt rather strong antipathy in most villages. People got used to - and tired of - being objects of diverse social and socio-economic studies. In fact this made research in the field even more complicated than elsewhere. Like in other regions they complained that most scientists just take their time and information, but do not pay anything or provide some kind of feedback on village level (vpb 22, 25, 26 & 27). Despite this criticism, AVIGREFs were also aware that researchers contributed to the establishment of the co-management approach (vpb 24 & 27).

W Benin

Like in most other areas, exchange with researchers was only sporadic and spatially limited. Topics ranged from the exploitation of trees (vpb 21) to their relation to specific actors and their attitude towards the park (vpb 17 & 21). Criticism also was similar to arguments voiced by other vpbs: "There are no conflicts, but the cooperation is bad. (…) We provide all the information, the researchers take it and disappear. And that's it. We do not have any benefits, and we do not see the results." (vpb 20).

Chapter 8

Annex 8.1: Threat analysis (expert interviews)

One of the most widespread and basic approaches to assess the context and success of management interventions is the evaluation and monitoring of threats facing PAs. Though being a proxy for the actual status of resources, this procedure has the advantages of being sensitive to changes over short time periods, cost-effective and easy to interpret (Salafsky & Margalouis 1999). However, based on scoring data, these assessments are usually subjected to bias.

As an introduction, we here reviewed threat status as judged by (local) PA experts. Data was obtained from grey project literature.

Tab. 8.1: Relative importance of threats in the three major blocks of the WAP complex, taken form project document UNDP PIMS 1617 (2005) (1= weak; 5= severe)

Threat	W	Arly	Pendjari	
Agricultural Encroachment	2	1	1	**4**
Uncontroled transhumance	3	3	1	**7**
Poaching	2	3	1	**6**
Uncontrolled bush fires	3	3	2	**8**
Siltation and pollution of surface waters	2	2	2	**6**
Climate change and climate variability	1	2	1	**4**
NTFP exploitation	1	1	1	**3**
Woodcutting	3	3	1	**7**
Fisheries	1	1	3	**5**
Total degree of threat	**18**	**19**	**13**	

One of the view documents that goes beyond just citing different sorts of threats, but giving at the same time weighted scores to each of them according to their intensity, is the project implementation manual "Enhancing the effectiveness and catalyzing the sustainability of the W-Arly-Pendjari (WAP) protected area system" produced for UNDP/GEF in 2005. Selection and weighting of threats was made by a group of experts familiar with the WAP complex. Their scores ranked from 1 (weak) to 5 (severe) and included both, the PA core and surrounding areas. **Tab. 8.1** gives the means of their estimates. (Unfortunately there is no information given with regard neither to identity nor number of experts interviewed.)

Surprisingly, no single threat for any of the three blocks has been evaluated worse than intermediate. Moreover, the top-ranking threat was assessed to be uncontrolled bush fires, i.e. no direct form of (extractive) use. In fact, use of bush fires as a management tool was being implemented throughout the complex, and most management authorities intentionally burned large surfaces at the beginning of the dry season in order to avoid more devastating late fires (see Chapter 4). Ultimate aim of this practice was to keep savannah open from re-growth of bushes and trees and so to provide good visibility (for tourists and hunters), as well as to attract large herbivores by ensuring protein-rich pasture during the season. Uncontrolled fires were usually made by poachers for the same reasons. By burning at the end of the dry season, these fires might, however, be of higher intensity and pose immediate threat to certain habitats, e.g. riparian forests. Grégoire and Simonetti (2010) carried out a long term study on fire dynamics of the WAP and found inter alia that the mean number of fires within the complex was lower than in many other PAs of the Soudanian Zone. Details of their study and fire as a management tool in general are discussed in Chapter 4.

It is noteworthy that Block Arly and Block W faced very similar patterns of threats, whereas the Pendjari Block came off best in most cases. Just fisheries along the Pendjari River were scored worse than elsewhere. This is congruent with the results of an internal assessment of the Pendjari Park authorities using the "Enhancing our Heritage" evaluation framework in 2008. However, forming the international border between Burkina Faso and Benin, the Pendjari River and its fisheries formed part of both, the Pendjari block as well as the Arly block. In fact, questionable practices on the side of Burkina and a lack of cooperation between authorities on both sides of the border led to a self-perpetuating process that pushed fish exploitation activities ever more towards unsustainable levels. In general though, results of the discussed assessment were considered to give a realistic picture of the relation of these different threats among each other and among the different PA blocks.

A second study based on expert opinion was conducted by the IUCN driven project "Aires Protégées d'Afrique du Centre et de l'Ouest" (Papaco). This project aimed at strengthening PA management capacities in West Africa by conducting evaluations of national PA systems using the "Rapid assessment and prioritization of Protected Area Management" (RAPPAM) framework. In November 2008, a workshop was held in Burkina Faso and management authorities (private and governmental) of all PAs in Burkina Faso were invited to elaborate the RAPPAM questionnaires in a participatory

process. After initial discussion, five threats of major importance were selected for further debate. **Tab. 8.2** gives scoring results for all PAs/ concessions that form part of the WAP complex. Each score was compiled by multiplication of three categorized variables (extent, impact, permanence) and finally standardized to a maximum of 100.

Tab. 8.2: Major threats to PAs/ concessions in Burkina Faso. Data was collected during a workshop of experts by IUCN PAPACO using the RAPPAM evaluation framework (Each threat is calculated by multiplying the scores of extent, impact and permanence. Scoring is based on a scale of four levels; high numbers denote high degrees of threat)

Pressure	Arly	Koakrana	Konkonbouri	Ouagarou	Pagou Tandougou	Pama Centre Nord	Pama Centre Sud	Pama Sud	Singou	Average BlockArly	SD	Tapoa Djerma	Kourtiagou	PN W	Average Block W	SD
Agricultural encroachment	56	56	38	56	56	0	25	75	100	**51**	29	19	19	19	**19**	0
Transhumance/ pastoralism	56	38	100	19	38	75	75	75	38	**57**	26	28	28	28	**28**	0
Poaching	19	25	28	25	28	42	13	56	38	**30**	13	56	56	56	**56**	0
Uncontrolled bush fires	38	75	50	75	38	75	100	75	28	**62**	26	0	0	0	**0**	0
Woodcuting	0	19	0	38	0	75	38	0	28	**22**	24	0	0	0	**0**	0
	169	213	216	213	159	267	250	281	231			103	103	103		

Like in the assessment of UNDP/GEF (2005), uncontrolled bush fires had been scored as the most severe threat menacing PAs of the Arly Block as well, followed by transhumance and agricultural encroachment. Poaching did not seem to play a major role in this block that was dominated by private-led hunting concessions[4]. The opposite was true for the Block W Burkina Faso, which was dominated by the state-led NP, where poaching turned out to be of major importance, also followed by transhumance and agricultural encroachment (though both threats scored lower than in Arly). Within Arly, Pama and Singou represented the most threatened areas, when scorings for all threats were summed up.

Given the lack of "hard" data, participatory processes might be assumed as the best way to evaluate immediate threats: each answer given by an expert for a specific PA is

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[4] In fact, poaching in Arly „NP" constituted a major problem as there was no management at all at the time of our study. This is acknowledged in the official publication of the WS (UICN/PACO 200), however, was not mirrored in the data given to us.

being discussed in group, so to reassure data quality. However, during this workshop it became obvious that the whole process had to tackle severe constraints resulting from incompetence of several participants that were sent from their superiors, as well as from hierarchical dependence among participants (forest officers). Quite openly superiors opposed subordinates and corrected their statements, whereas answers form certain private actors were accepted without contradiction though obviously being wrong. The mix of stakeholders belonging to different actor groups, in particular private concessionaires or their representatives and governmental officers, also proved to bear difficulties. Some of the governmental actors e.g. tended to answer more positive and so tried to minimize or even conceal major deficiencies of governmental conservation and management efforts, whereas some private actors used to over-emphasize these shortcomings of governmental capacity to organize proper management. The power relations among participants hence were strongly influencing the participatory process. We therefore refrain from further discussion of the data and give a summary of the findings of both assessments in **Tabl.3**.

Tab. 8.3: Synthesis of threat assessment based on expert opinion. For explanations see note below table

Threat/ Pressure	UNDP				RAPPAM/IUCN		
	W	Arly	Pendjari	Sum/pot max	W BF	Arly	Sum/pot max
Agricultural Encroachment	2	1	1	**0,3**	3	3	**0,5**
Uncontroled transhumance	3	3	1	**0,5**	2	3	**0,5**
Poaching	2	3	1	**0,4**	1	2	**0,4**
Uncontrolled bush fires	3	3	2	**0,5**	0	4	**0,4**
Siltation and pollution of surface waters	2	2	2	**0,4**	-	-	**-**
Climate change and climate variability	1	2	1	**0,3**	-	-	**-**
NTFP exploitation	1	1	1	**0,2**	-	-	**-**
Woodcutting	3	3	1	**0,5**	0	2	**0,2**
Fisheries	1	1	3	**0,3**	-	-	**-**
Total degree of threat (sum/pot max)	**0,3**	**0,3**	**0,2**		**0,2**	**0,6**	

Note Table 3: Data from IUCN RAPPAM was transformed to the same categories as UNDP estimates (0-20 credits=1=weak; 20-40 credits=2=intermediate to weak; 40-60 credits=3=intermediate; 60-80 credits=4=intermediate to severe; 80-100 credits=5=severe; general degree of intensity of single threats as well as overall threat intensity for each PA was standardised by dividing line, resp. column total by the potential maximum.

Detailed analysis of the major threats (poaching and transhumance) on a system-wide scale was not possible. Statistics on offenses produced by park authorities proved to be fragmentary, and could not be relativized to enforcement effort, i.e. there was no common denominator for the data gathered by different authorities. In the following, therefore, we directly concentrate on agricultural pressure, respectively the status of different resources.
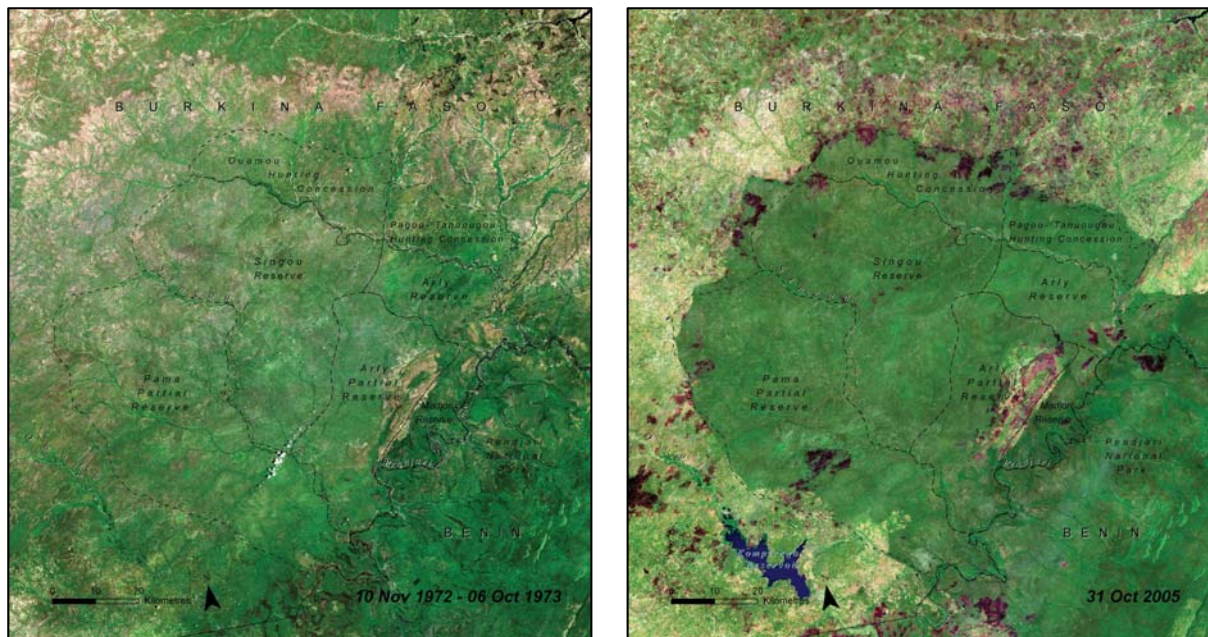
Fig. 8.9: Two satellite images of the Arly Block, the left one dating from 1972/73, the right one from 2005. In 2005 heavy land cover change dominates the landscape outside PAs. Dark spots originate from recent fires. A large area of water (Kompienga Reservoir) can be seen in the south west (Taken from: UNEP 2008. AFRICA Atlas of our Changing Environment)
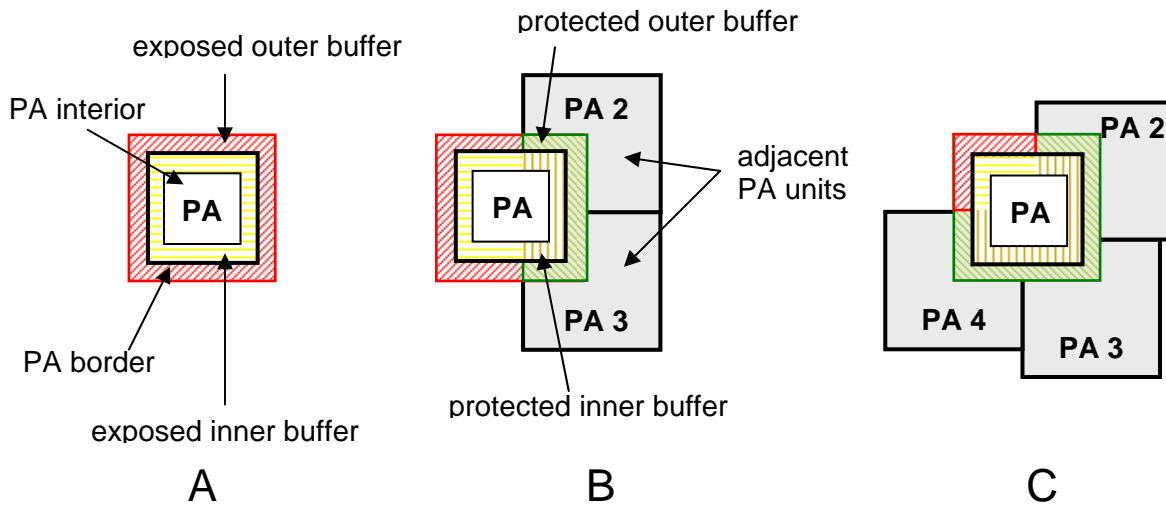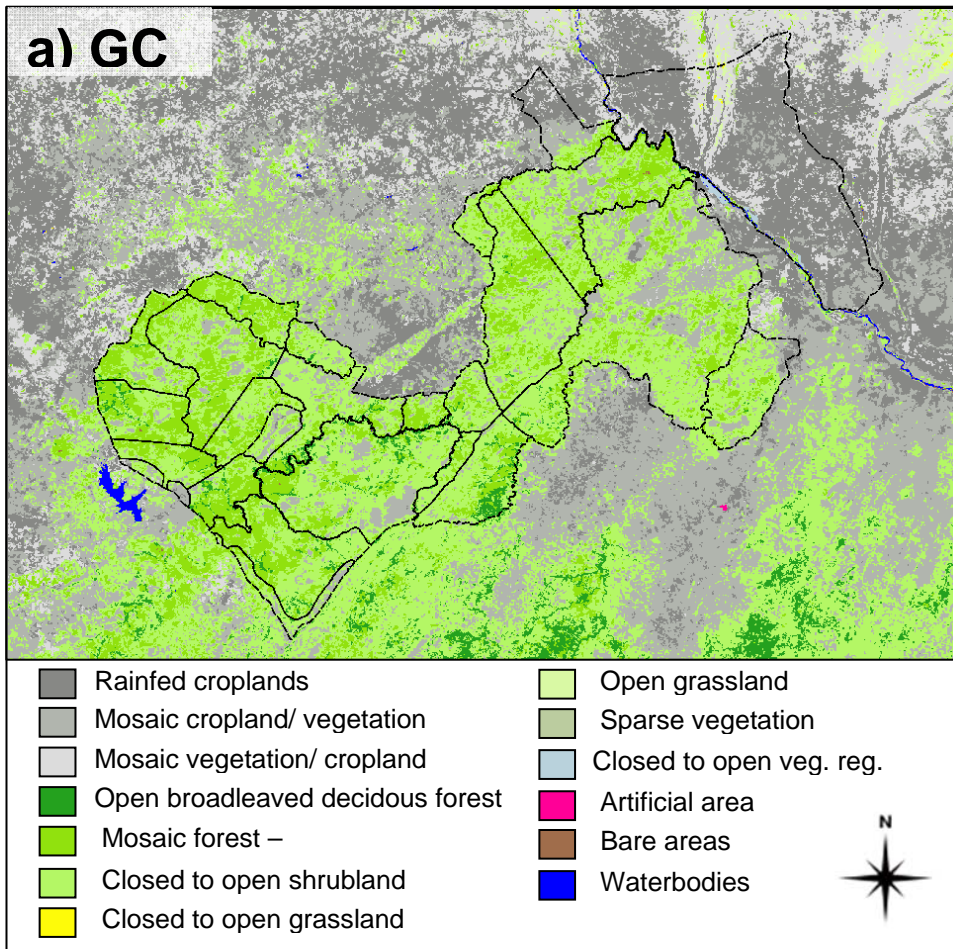
Fig. 8.10: Graphics A-C demonstrate the problem of exposure. A) single PA with 100% exposed outer and hence 100% exposed inner buffer ("island"); b) PA that directly borders to other PAs; these PAs can also be seen as buffer zones for the PA unit in question. The exposed buffer zone hence is reduced (red zone); C) further exemplifies the principle

Tab.8.4: Ratios of total buffer sizes to exposed (i.e. not part of an other PA) areas of respective buffer.

	ratio 5 km outer buffer	ratio 30 km outer buffer	ratio 5 km inner buffer
Arly			
Pama Nord	0,40	0,52	0,45
Pama Centre Nord	0,25	0,49	0,25
Pama Centre Sud	0,42	0,49	0,48
Pama Sud	0,28	0,39	0,32
Konkombouri	0,23	0,13	0,42
Singou	0,02	0,42	0,03
Ouagarou	0,47	0,56	0,50
Pagou Tandougou	0,39	0,49	0,53
Arly	0,27	0,26	0,36
Koakrana	0,29	0,29	0,40
W Burkina Faso			
Parc W Burkina	0,23	0,46	0,30
Tapoa Djerma	0,57	0,63	0,73
Kourtiagou	0,26	0,32	0,33
W Benin			
Mekrou	0,46	0,39	0,58
Parc W Benin	0,51	0,54	0,52
Djona	0,65	0,68	0,67
Pendjari			
Pendjari S	0,52	0,62	0,54
Pendjari N	0,10	0,33	0,12
Konkombri	0,01	0,30	0,07
W Niger			
W Niger	0,14	0,26	0,15
Tamou	0,66	0,55	0,81
Dosso	0,86	0,77	0,86

a) GC

Legend:
- Rainfed croplands
- Mosaic cropland/ vegetation
- Mosaic vegetation/ cropland
- Open broadleaved decidous forest
- Mosaic forest –
- Closed to open shrubland
- Closed to open grassland
- Open grassland
- Sparse vegetation
- Closed to open veg. reg.
- Artificial area
- Bare areas
- Waterbodies

Fig. 8.11: Land cover maps of the WAP complex based on GC (a) and GLC (b) classifications. Black lines are boundaries of PA units

b) GLC

Legend:
- Decidous woodland
- Decidous shrubland with sparse
- Open grassland with sparse shrubs
- Open grassland
- Croplands (>50%)
- Croplands & open woody
- Waterbbodies

A outer buffer   **B** inner buffer
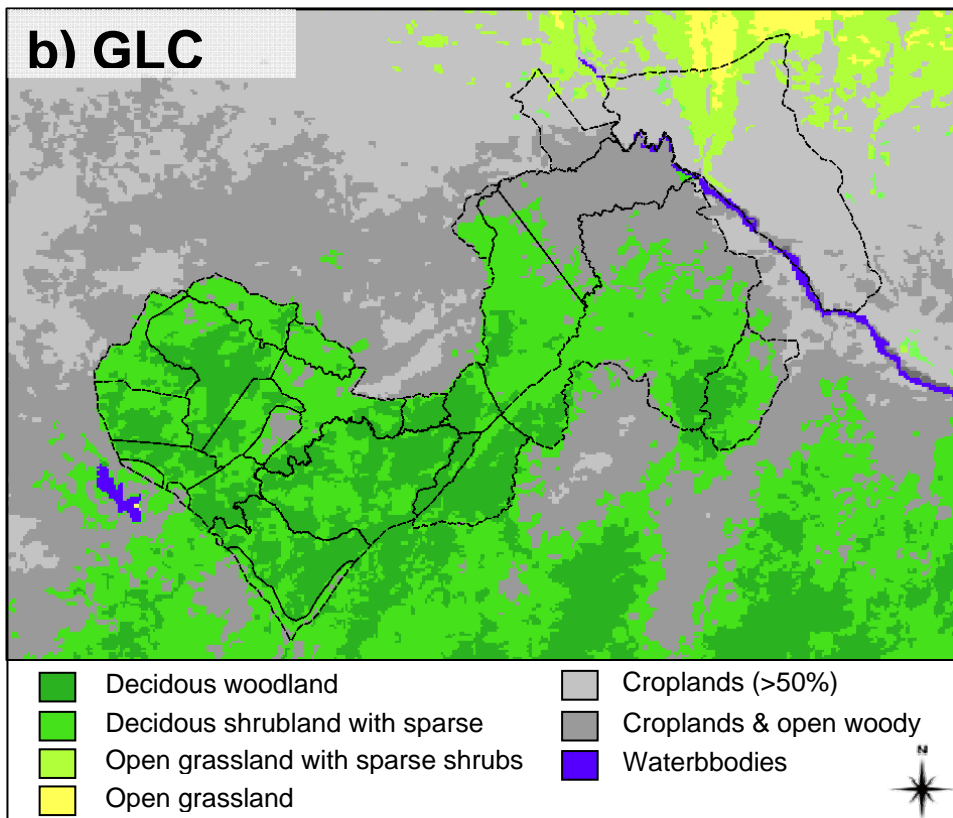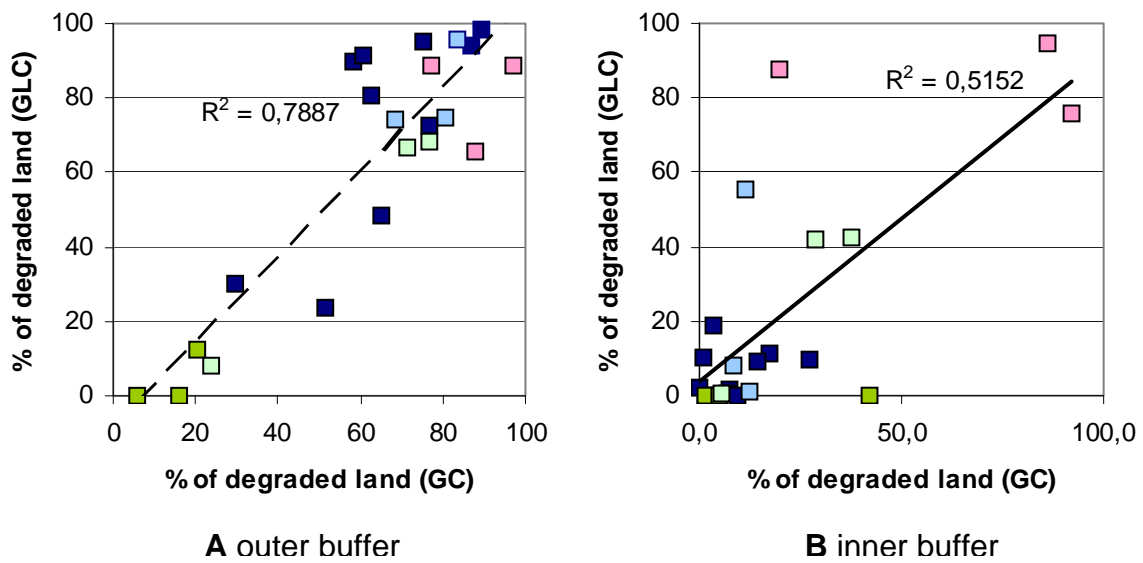
Fig. 8.12: Correlation of results obtained by GLC and GC (%degraded land in 5km buffer zones) for outer buffer (A, left) and inner buffer (B, right). Both correlations are significant (p<0,00). Color gives PA block affiliation of single PA units: light green= W Benin, green= Pendjari, light blue= W Burkina Faso, dark blue= Arly Burkina Faso

Tab. 8.5: Threat indicators for all PA units based on land conversion in 5 km and 30 km outer buffers

	% of highly degraded land (mean GC/GLC, 30 km buffer)	threat indicator 30 km	threat indicator 5 km	Ratio threat indicators 30km/5km
Arly				
Pama Nord	90,7	47,2	37,6	1,3
Pama Centre Nord	71,9	35,3	18,5	1,9
Pama Centre Sud	49,5	24,3	23,8	1,0
Pama Sud	37,2	14,5	10,5	1,4
Konkombouri	46,6	6,1	6,9	0,9
Singou	80,6	33,8	1,7	19,9
Ouagarou	83,5	46,8	35,8	1,3
Pagou Tandougou	83,5	40,9	29,1	1,4
Arly	82,7	21,5	19,3	1,1
Koakrana	88,4	25,6	26,2	1,0
W Burkina Faso				
Parc W Burkina	86,1	39,6	16,4	2,4
Tapoa Djerma	93,1	58,6	51,1	1,1
Kourtiagou	79,7	25,5	20,2	1,3
W Benin				
Mekrou	40,4	21,8	8,2	2,7
Parc W Benin	80,8	31,5	31,7	1,0
Djona	77,2	52,5	47,1	1,1
Pendjari				
Pendjari S	21,4	13,3	8,5	1,6
Pendjari N	31,4	10,4	0,3	34,5
Konkombri	23,5	7,1	0,1	86,8
W Niger				
Parc W Niger	88,9	23,1	11,6	2,0
Tamou	85,9	47,2	61,2	0,8
Dosso	76,4	58,8	66,0	0,9

Tab. 8.6: results of land cover analysis for all PA units by classification (5 km outer and inner buffer)

	5 km-inner buffer						5 km-outer buffer					
	% of degraded land (GC)	% of degraded land (GLC)	mean	SD	buffer ratio	threat indicator	% of degraded land (GC)	% of degraded land (GLC)	mean	SD	buffer ratio	threat indicator
Arly												
Pama Nord	3,3	19,06	11,2	11,2	0,45	**5,0**	89,46	98,6	94,0	6,5	0,40	**37,6**
Pama Centre Nord	7,5	1,67	4,6	4,1	0,25	**1,2**	58,49	89,56	74,0	22,0	0,25	**18,5**
Pama Centre Sud	7,1	0,75	3,9	4,5	0,48	**1,9**	65,14	48,4	56,8	11,8	0,42	**23,8**
Pama Sud	9,3	0,12	4,7	6,5	0,32	**1,5**	51,37	23,88	37,6	19,4	0,28	**10,5**
Konkombouri	1,7	0	0,8	1,2	0,42	**0,4**	29,51	30,18	29,8	0,5	0,23	**6,9**
Singou	0,0	2,04	1,0	1,4	0,03	**0,0**	75,44	95,01	85,2	13,8	0,02	**1,7**
Ougarou	0,9	10,44	5,7	6,7	0,50	**2,8**	60,81	91,65	76,2	21,8	0,47	**35,8**
Pagou Tandougou	17,4	11,27	14,3	4,3	0,53	**7,6**	76,65	72,67	74,7	2,8	0,39	**29,1**
Arly	14,4	9,22	11,8	3,7	0,36	**4,3**	62,63	80,63	71,6	12,7	0,27	**19,3**
Koakrana	27,3	9,81	18,6	12,4	0,40	**7,5**	86,66	94,24	90,5	5,4	0,29	**26,2**
W Burkina												
Parc W Burkina	8,6	7,89	8,3	0,5	0,30	**2,4**	68,63	74,17	71,4	3,9	0,23	**16,4**
Tapoa Djerma	11,6	55,28	33,4	30,9	0,73	**24,3**	83,44	95,9	89,7	8,8	0,57	**51,1**
Koutiagou	12,3	1,07	6,7	7,9	0,33	**2,2**	80,36	74,98	77,7	3,8	0,26	**20,2**
W Benin												
Mekrou	5,3	0,32	2,8	3,5	0,58	**1,6**	23,99	8,21	16,1	11,2	0,51	**8,2**
Parc W Benin	28,9	41,91	35,4	9,2	0,52	**18,3**	71,32	66,71	69,0	3,3	0,46	**31,7**
Djona	37,7	42,41	40,1	3,3	0,67	**26,8**	76,52	68,38	72,5	5,8	0,65	**47,1**
Pendjari												
Pendjari ZC	1,7	0	0,8	1,2	0,54	**0,5**	20,49	12,16	16,3	5,9	0,52	**8,5**
Pendjari	41,9	0	20,9	29,6	0,12	**2,4**	6,01	0	3,0	4,2	0,10	**0,3**
Konkombri	4,8	0	2,4	3,4	0,07	**0,2**	16,25	0	8,1	11,5	0,01	**0,1**
W Niger												
Parc W Niger	19,9	87,54	53,7	47,8	0,15	**8,2**	77,35	88,57	83,0	7,9	0,14	**11,6**
Tamou	86,0	94,71	90,4	6,1	0,81	**73,0**	96,95	88,49	92,7	6,0	0,66	**61,2**
Dosso	92,1	75,72	83,9	11,6	0,86	**72,1**	87,79	65,69	76,7	15,6	0,86	**66,0**
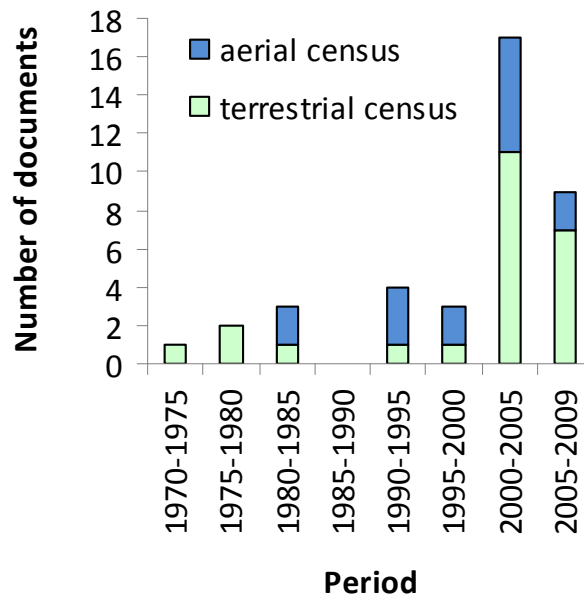
Fig. 8.13: temporal distribution of documents (surveys) obtained and relation of terrestrial to aerial censuses