CONNECTIVITY CONSERVATION OF THE GREAT GREEN MACAW'S LANDSCAPE IN COSTA RICA AND NICARAGUA (1994-2012)

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ABSTRACT

Important fragments of primary and secondary forest in southeastern Nicaragua and northern Costa Rica are being threatened by anthropogenic actions. Since 1994, a research and conservation project focused on the great green macaw (*Ara ambiguus*) has allowed us to implement integral conservation actions at the landscape level including the creation of an alliance of 22 organizations working together to establish and develop the San Juan-La Selva Biological Corridor and the Maquenque National Wildlife Refuge as its core area. Since 2000, this experience has been replicated in Nicaragua and the links between both countries have been strengthened, resulting in a grassroots transboundary campaign focused on promoting the awareness of the ecology and conservation of the great green macaw in the lowlands of the San Juan River. The most important results to date have been the understanding, acceptance and concern of the major stakeholders regarding the challenges faced by the great green macaw, a positive shift in land use change dynamics at the landscape level and the recuperation of the population of the great green macaw.

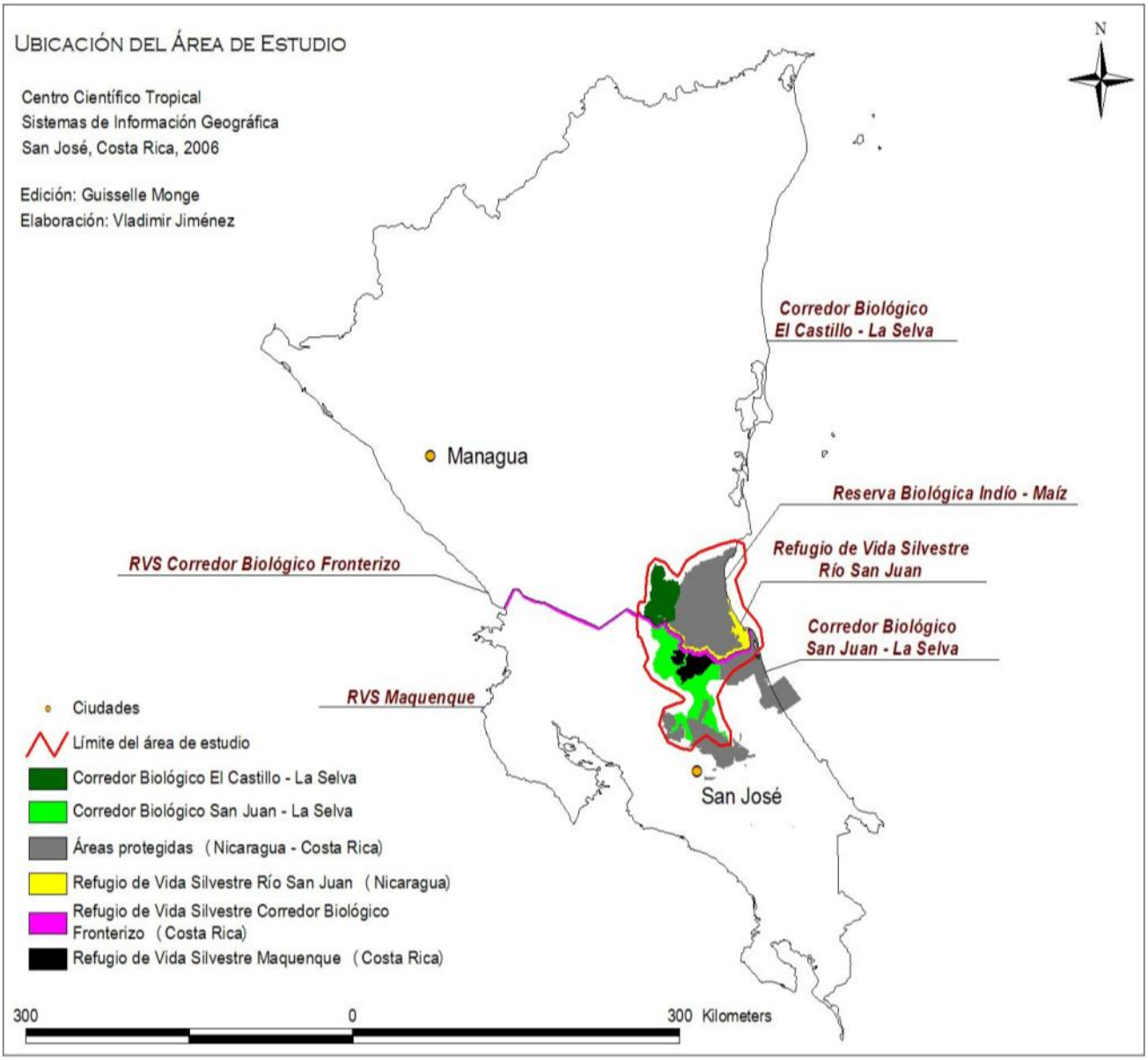
THE GREAT GREEN MACAW

The great green macaw (*Ara ambigus*) has a limited distribution in the Atlantic wet lowlands of Central America, from eastern Honduras to northern Colombia, with a small isolated population in the Pacific in Esmeraldas and Guayaquil, Ecuador. The total population is about 7,000 individuals (Monge et al., 2009) and the macaw is assessed as endangered by IUCN's Species Survival Commission. In Costa Rica, this species is currently limited to 600 km^2 of tropical very wet forest in the northern part of the country on the border with Nicaragua. The macaw depends on the mountain almendro tree (*Dipteryx panamensis*), both for feeding and nesting substrate (Monge et al., 2003). This magnificent bird has been in serious danger of disappearing from Costa Rica, although recently its population has increased due to improved policy, governance and to the implementation of a connectivity conservation initiative (Chassot et al., 2010a).

THE PROJECT

The '*Great Green Macaw Research and Conservation Project*' was launched by George V. N. Powell in 1994 and aims to study the conservation biology of the macaw in northern Costa Rica. It has developed a major biological data base on this species. The project's first-year findings highlighted that the nesting range of the macaws in Costa Rica had been reduced by 90 per cent since the early 20th Century (Powell et al., 1999). Preliminary studies found that the great green macaw's limited distribution and relatively large home range, combined with its dependence on a complex array of food resources, implied that the protection of its habitat and resources would benefit a multitude of other species that reside in these lowland wet forests. The potential of this species as an 'umbrella species' for the fauna and flora of the habitat where it thrives makes it a key species to study in order to set conservation priorities, particularly due to the fact that the study site was lacking an important protected area. The northern zone of the range had suffered the highest deforestation rate in Costa Rica in the 1980s and 90s, leaving less than 30 per cent of the original forest standing (Chassot et al., 2005). Nevertheless, several studies found that the forests in this region remained amongst the most diverse in Central America (Chassot et al., 2005).

In 1994, we estimated the great green macaw population in Costa Rica to be approximately 210 individuals with 25 -35 breeding pairs. The population has a more extensive habitat and presumably larger macaw population than in the Indio-Maíz Biological Reserve in Nicaragua. Nevertheless, logging incursions across the San Juan



Map of the project area

River into the Indio-Maíz are common, and even this reserve, Central America's most important on the Atlantic slope, is not free from deforestation. Consequently, today the great green macaw population is in a precarious and fragile condition, and the loss of remaining forest habitat in northern Costa Rica or southern Nicaragua may result in regional extinctions (Monge et al., 2009).

RESEARCH RESULTS

At the onset of the project in the 1990s, little was known about the ecology of the great green macaw. While it was thought to migrate seasonally and use a variety of habitats at different elevations, its nest had not been described and its primary habitat and food sources were largely unidentified. The research objective, therefore, was to compile basic data on the macaws' habitat and spatial requirements in order to set priorities for the conservation of sufficient habitat to support a viable population of the macaw in Costa Rica.

We used radio-telemetry to determine macaw home ranges and habitat use. In addition, we have monitored the status of all known (N=85, 2010) or suspected nest sites and collected data on nest site characteristics. Finally, we studied the fruiting phenology of tree species that we discovered form part of the macaws' diet.

The extensive data base developed includes information on breeding range in Costa Rica, general nesting data, nest sites, nest fidelity, nesting resources, nest productivity, first-year survival of juveniles, non-nesting population, migration patterns and foraging behaviour, amongst others (Powell et al., 1999; Monge et al., 2003).

THE CONSERVATION PLAN

In Nicaragua and Costa Rica, areas of pristine and degraded forests are threatened by logging and conversion to monocultures such as pineapple and African palm (Chassot et al., 2008; Fundación del Río, 2012). The forest industry and large agro-industrial corporations take advantage of the absence of governance and adequate policies for sustainable management of natural resources.

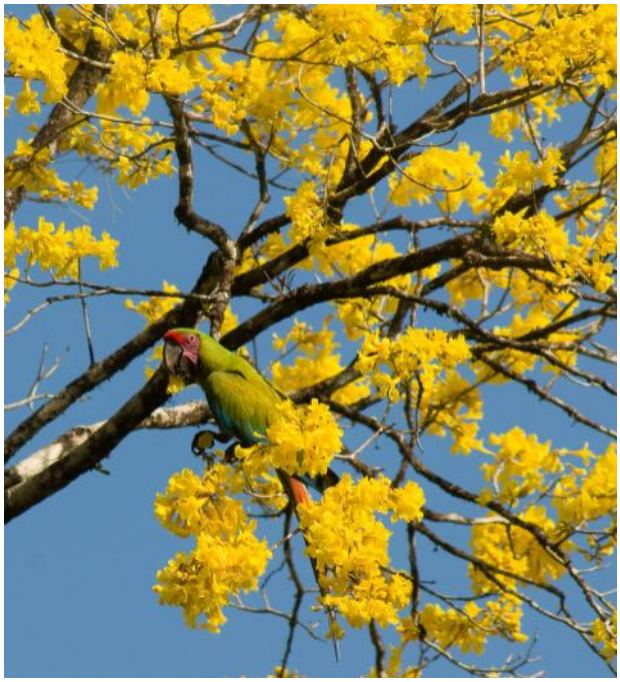
The survival of the great green macaw depends on the availability of adequate forest habitat. In 1998, working with local and national stakeholders, the research team proposed the implementation of a conservation plan that could protect enough habitat to maintain a viable breeding population in Costa Rica. Known as the 'San Juan-La Selva Biological Corridor', the plan included the creation in 2005 of the 'Maquenque National Wildlife Refuge', Costa Rica's last large protected area, extending 54,000 hectares of natural ecosystems embracing the breeding range of the great green macaw (Chassot et al., 2005; Villate et al., 2009).

The research project succeeded in restricting timber cutting in the critical nesting area of the macaw as well as halting the unsustainable harvest of the mountain almendro. To promote sustainable development and conservation in the northern part of Costa Rica, local farmers and communities were encouraged through incentives from the government, to support reforestation initiatives with native trees that are both commercially important and of benefit to the great green macaw.

To resolve nest poaching, during the early stages of the project the research team developed an 18 month intensive environmental education programme for different communities within the influence area.

THE BIOLOGICAL CORRIDOR

The area of humid Atlantic tropical forest in the north of Costa Rica maintains the only viable lowland habitat able to maintain the continuity of the Mesoamerican Biological Corridor between Costa Rica and Nicaragua. The San Juan-La Selva Biological Corridor (246,608 hectares) promotes restoration and preserves connectivity conservation between remnants of forest in the Central Volcanic Mountain range and the La Selva Biological Station (125,691 hectares) in the north of Costa Rica, and the Barra del Colorado National Wildlife Refuge (102,165 hectares) and Tortuguero National Park (29,068 hectares) in the Caribbean coast of Costa Rica. This connectivity is even more important given its link with the extensive conservation complex, which includes



Great Green Macaw © Roland Seitre

the Indio-Maíz Biological Reserve (306,980 hectares), Punta Gorda (54,900 hectares) and Cerro Silva (339,400 hectares) in Southeastern Nicaragua. The San Juan-La Selva Biological Corridor consolidates these six protected areas into a single biological unit, covering 1,204,812 hectares (Monge et al., 2002).

The central conservation unit of the San Juan-La Selva Biological Corridor is the Maquenque Mixed National Wildlife Refuge (54,000 hectares), located to the south of Indio-Maíz Biological Reserve and contiguous with the westernmost limits of Barra del Colorado. This new protected area conserves the area of the corridor with the highest percentage of forest cover. The humid tropical forest of the Atlantic included within the biological corridor and adjacent connected protected areas are biologically diverse, considered the home of 6,000 (36) species of vascular plants (number of vulnerable and endangered species in parenthesis), 139 (32) species of mammals, 515 (64) birds, 135 (35) reptiles and 80 (45) amphibians (Chassot et al., 2005).

COMMUNITY GOVERNANCE AND OPPORTUNITIES

The Local Council of the San Juan-La Selva Biological Corridor was officially formed in March 2001 as a result of an alliance between the Tropical Science Center, the Wildlife Conservation Society, the Organization for Tropical Studies, the Mesoamerican Biological Corridor-Costa Rica, and the Great Green Macaw Research and Conservation Project. Likewise, in 2002, the local office of the San Juan-La Selva Biological Corridor was created

Tropical wet forest landscape © Roland Seitre

in Puerto Viejo de Sarapiquí. The Council has its headquarters at the Tropical Science Center, in San José, and is responsible for coordinating and promoting the implementation of the corridor. Currently, the Council includes 22 organizations from the state and the civil society and each organization has clearly defined responsibilities within the Council, according to its own agenda and field of expertise (Chassot et al., 2005).

The territory of the Maquenque National Wildlife Refuge, the principal conservation area within the Corridor, is considered the Council's highest priority. Three tracts of forest are seen as the priority and constitute the 'nuclei' of the Corridor, the remaining territory makes up the Corridor 'matrix'. The goal of the Corridor initiative is to preserve 100 per cent of the nuclei and 50 per cent of matrix habitat via environmental service payments to private landowners. Such financial incentives strongly influence land use trends in the country and have been specifically expanded and better publicized in the Corridor to foster landowner participation at the larger, more biologically relevant scales required to implement the Corridor initiative (Chassot et al., 2005).

The Council plans to generate employment opportunities in an area that is economically depressed. Employment currently depends on limited forestry and agricultural activities, such as pineapple monoculture, which has aggressively expanded throughout the landscape, further limiting connectivity restoration opportunities (Chassot et al., 2010a). A shift from these activities to a more integrative socio-economic vision based on small-scale ecotourism promoted through capacity-building aims to foster more long-term and sustainable employment opportunities. For example, there is a community-based ecotourism development strategy with local landowners, enhanced by the 'San Juan-La Selva Birding Route', which has developed birding routes, tours and easily accessible tourism information on the internet (Rainforest Biodiversity Group, 2010).

Costa Rican and Nicaraguan people are becoming increasingly aware that species such as the West Indian manatee (*Trichechus manatus*) and the great green macaw are part of their national heritage. The environmental education programme informs schoolchildren how conservation efforts that preserve and connect habitats can help protect such species of national importance.

NICARAGUA-COSTA RICA

The environmental partnership between Costa Rica and Nicaragua is the result of various workshops held to build an integrated conservation model that led to the SI-A-PAZ initiative (International System of Protected Areas for Peace) in the 1980s. In April 1999, the

Bi-national Great Green Macaw Festival 2011 © Allan Valverde

Biosphere Reserve of Southeast Nicaragua was created, while in 2006 the 'Agua y Paz' Biosphere Reserve was created in Northern Costa Rica (Moreno, 2007).

In 2000 and 2001, The United Nations Development Programme (UNDP) facilitated bi-national meetings amongst Nicaraguan and Costa Rican institutions, establishing a working network of environmental, academic, cultural and media sectors from both countries. Since 2001, the Mesoamerican Biological Corridor has supported a bi-national collaborative process which originated as part of the SI-A-PAZ process. This led to the identification of the bi-national El Castillo -San Juan-La Selva Biological Corridor, where the great green macaw, a flagship species for these territories, thrives and reproduces (Chassot et al., 2003; Chassot and Monge, 2008).

A bi-national campaign 'Save the Great Green Macaw' has been running since 2001 in conjunction with Fundación del Río in Nicaragua and the Tropical Science Center in Costa Rica. This bi-national experience has illustrated how protected areas can maintain the biological and social relationships within the San Juan-La Selva basin (Chassot et al., 2010b). In 2002, eleven workshops on the biology and conservation of the great green macaw were held in Nicaragua and ten bi-national festivals were organized. This process also led to the creation of the Bi-national Commission of the El Castillo-San Juan-La Selva Biological Corridor (which includes government agencies, local governments and NGOs from both countries) in November 2002, which formalises the development of bi-national activities (Chassot et al., 2006).

Some outcomes from the transboundary conservation process include (Chassot and Monge, 2008):

- Integration of local communities into monitoring and raising awareness to protect the habitat of the Great Green Macaw.
- Development of a participative process to build up stakeholders' capacity.
- Integration of policy planning at the local government scale.
- Dramatic increase in available information.
- Sharing of experience (for example: environmental services payment).
- Assimilation of different topics related with natural resources management by local people.

Thus the effort to conserve the meta-population and habitat of great green macaws has helped strengthen collaborative links between Nicaragua and Costa Rica – at least on some levels. Even after more than 10 years of transboundary cooperation between Nicaragua and Costa

Bi-national Great Green Macaw Monitoring Children's Network 2009 © Guisselle Monge

Rica built on the SI-A-PAZ initiative, institutional arrangements at the governmental level have not been adequately addressed, as political differences have emerged and a common agenda has not been implemented despite the interests of bilateral cooperation agencies. On the other hand, civil society has successfully implemented the agenda of peaceful collaboration amongst local stakeholders for the sake of connectivity conservation through an ecosystem based approach, and through sustainable development of remote communities that failed to be represented properly by central governments.

LESSONS LEARNED

The history of this connectivity conservation initiative, with a strong influence on sustainable development, has provided many lessons.

From its very beginning, the San Juan-La Selva Biological Corridor in Costa Rica has invested a great deal of its resources in raising a strong scientific database that justifies the different actions implemented. The information generated by the research and conservation project focused on the great green macaw has yielded political influence at different levels. An important lesson has been the implementation of environmental policies that favour decentralization processes, seeking local governance with capacity to address regional needs. The incorporation of local stakeholders from different sectors has favoured participation for decision-making processes. The result is a social cohesion that starts from a shared cultural identity (Villate et al., 2009).

The long and intense process of environmental education and capacity-building, along with information campaigns, cultural events and other activities has allowed many communities to identify themselves with the plight of the great green macaw (Fundación Loro Parque, 2010). Furthermore, the direct and active participation of the community in the research and conservation process of the macaw has favoured its empowerment in conservation and sustainable development issues. Thus, these direct investments in social capital strengthen cultural values that permeate the social level, with shared ideas around an environmental concept (Villate et al. 2009).

The connectivity conservation concept to promote the protection of the great green macaw has proven to be a promising model for natural resources and landscape management. As part of its success, it is important to highlight that the implementation of this strategy is based on an absolute institutional transparency (information and resources management) and a solid scientific basis, and has always been open to include all stakeholders willing to participate. This generated institutional trust and helped the initiative grow year after year (Chassot et al., 2010b).

Other processes which contribute to the optimal functioning of the Council of the San Juan-La Selva include:

- An adaptative management and multidisciplinary approach.
- Horizontal participatory management.
- Consensual decision-making process.
- Good leadership, effective follow-up and ethical process from the coordinators of the Council.
- Efficient budgeting, in terms of funds spent and investments made.
- Applied research for management.

These elements have contributed to create a unique organizational culture that has served as a model for many similar initiatives. San Juan-La Selva has been considered the most advanced conservation connectivity project in Mesoamerica by CATIE and is often regarded as a model to inspire countless other conservation connectivity initiatives in Costa Rica and Mesoamerica. This connectivity conservation has cost US$650.000 for ten years of project work.

In terms of conservation success, studies show that the population of great green macaws has increased in size, from 210 to 302 individuals since 1994; and that deforestation rates within the San Juan-La Selva Biological Corridor are below the national mean deforestation rate and the deforestation rate just outside the territory of the corridor (Chassot et al., 2010a).

Table 1: Project timelines

Year	Event
1993	Preliminary field study Great Green Macaw population estimate for Costa Rica: 210 individuals
1994	Launching of the Great Green Macaw Project Intensive environmental education programme (pride campaign)
1996	Creation of the National Commission of the Great Green Macaw National decree of partial prohibition of Almendro tree harvest
1997	Administrative back-up from the Tropical Science Center to the Great Green Macaw Project
1998	First draft of the Conservation Plan for the Great Green Macaw
1999	Feasibility study for the implementation of the San Juan-La Selva Biological Corridor
2000	Dissolution of the National Commission of the Great Green Macaw
2001	Creation of the Executive Committee of the San Juan-La Selva Biological Corridor Start of the partnership between the Tropical Science Center and Fundación del Río
2002	Creation of the Bi-national Commission of the El Castillo-San Juan-La Selva Biological Corridor First Great Green Macaw Bi-national Festival Conclusion of the telemetry monitoring programme
2003	Strategic Planning of the San Juan-La Selva Biological Corridor
2004	Appointment of two officials to follow up the project of Maquenque National Wildlife Refuge
2005	Creation of the Maquenque National Wildlife Refuge Update of the Red List category of the Great Green Macaw (from VU to EN, IUCN)
2006	Publication of the Technical Characterization of the El Castillo-San Juan-La Selva Biological Corridor Publishing of the Management Plan of the Maquenque National Wildlife Refuge Systematization of the bi-national experience around the conservation of the Great Green Macaw Creation of the Agua and Paz Biosphere Reserve
2007	Acquisition of the Great Green Macaw Field Station in Boca Tapada
2008	Systematization of the bi-national campaign for the Great Green Macaw Deforestation of the gold mining project in Crucitas Great Green Macaw PHVA Workshop
2009	Bi-national census show an increase in the population of the Great Green Macaw Systematization of the San Juan-La Selva Biological Corridor
2010	Project field house in Boca Tapada burnt down Great Green Macaw population estimate for Costa Rica: 302 individuals
2011	Official recognition of the Local Council of the San Juan-La Selva Biological Corridor Development of a communication strategy for the San Juan-La Selva Biological Corridor
2012	Creation of the Cureña Ecotourism Association (AECOTUCU)

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RESUMEN

Importantes fragmentos de bosque primario y secundario en el sureste de Nicaragua y en el norte de Costa Rica están sujetos a la amenaza de acciones antropogénicas. Desde 1994, un proyecto de investigación y conservación de la guacamaya verde mayor (*Ara ambiguus*) nos ha permitido implementar acciones de conservación integral en el ámbito del paisaje, incluyendo la creación de una alianza de 22 organizaciones que trabajan en conjunto para establecer y desarrollar el Corredor Biológico San Juan-La Selva y el Refugio Nacional de Vida Silvestre Maquenque como área núcleo. Desde el 2000, esta experiencia ha sido replicada en Nicaragua y los vínculos entre ambos países se han fortalecido, generando una campaña transfronteriza desde las bases y enfocada en la promoción de la conciencia acerca de la ecología y conservación de la guacamaya verde en las llanuras del río San Juan. Los resultados más importantes hasta la fecha han sido el entendimiento, aceptación y preocupación de los actores principales en relación a los desafíos enfrentados por la guacamaya verde, un cambio positivo en la dinámica de cambio de uso de la tierra en el paisaje y la recuperación de la población de la guacamaya verde.

RÉSUMÉ

D'importantes zones de forêt primaire et secondaire du sud-est du Nicaragua et du nord du Costa Rica sont menacées par les activités anthropiques. Depuis 1994, un projet de recherche et de conservation de l'ara de Buffon (*Ara ambiguus*) a permis de mettre en place des actions de conservation intégrales liées au paysage, notamment la création d'une alliance de 22 organisations qui travaillent ensemble pour créer et mettre en place le couloir biologique San Juan-La Selva et le Refuge national de faune Maquenque comme aire centrale. Cette expérience a été reproduite au Nicaragua à partir de l'année 2000 et les liens entre les deux pays ont été fortifiés, avec notamment le lancement d'une campagne de sensibilisation transfrontalière auprès du grand public, orientée vers l'amélioration de la prise de conscience du milieu naturel et la conservation de l'ara de Buffon dans les plaines du fleuve San Juan. Jusqu'à présent, les résultats les plus importants sont la compréhension, l'acceptation et la préoccupation des acteurs principaux face aux défis auxquels sont confrontés les aras de Buffon, une dynamique de changement positive dans l'utilisation des terres au sein du paysage et le redressement de la population d'aras de Buffon.