a trigger of migratory restlessness is beyond doubt, a growing number of studies point at the importance of interannual variation in winter climate as a predictor of arrival time in the summer quarters. Hence, the timing of migration may be pretty flexible even in long-distance migratory birds, and the detailed studies of the American redstart suggest that not only the speed of migration, but also the departure date can be affected by winter climate through its effect on habitat quality and thus the time needed to prepare for migration.

There are also observations that are not easily explained by a simple phenotypic response. For instance, the earlier arrival of African migrants on Capri cannot be fully explained by the climatic variables investigated so far. It has been suggested that the lack of explanation for the advanced arrival on Capri may be an indication of micro-evolution, but there are potential pitfalls to making premature claims about micro-evolution. Another interesting observation that is not easily attributed to phenotypic plasticity only is the increased response to temperature in SW Europe in the sand martin, *Riparia riparia*, which has resulted in earlier arrival in the UK at the same temperature as before. Again, the data at hand do not allow any formal test of the involvement of any micro-evolutionary processes, but they cannot be excluded either.

One may ask why we still lack conclusive evidence for evolutionary change despite selection for earlier arrival and the presence of genetic variation in the timing of migration, and plausible answers to this critical question are given by Pulido (2007). To some extent it is a data problem. Based on arrival data from bird observatories, we are not in position to differentiate between the relative roles of phenotypic plasticity and evolutionary responses, data do not unambiguously support or refute either of the 2 (not mutually exclusive) hypotheses. Interannual arrival data on individual birds, measured with high precision, would be useful for this purpose. Unfortunately, those kind of data are very scarce. However, there are other reasons why it is inherently difficult to find conclusive evidence for micro-evolution. For instance, to what extent changes in wind directions and speed can explain the earlier arrival of migratory birds is largely unexplored. Furthermore, since the physical condition of birds can affect departure time, we clearly need experimental studies on the wintering grounds to better understand the importance of carry-over effects that may persist over several generations. Hence, we need to appreciate the whole life cycle of events and not only to study spring migration as an isolated phenomenon. In that respect, the timing of autumn migration and how it relates to the timing of spring migration, and the selection pressures involved is, of course, of interest and has not received the attention it deserves.

In conclusion, we are now moving beyond the mere description of patterns and starting to think about the underlying mechanisms. Therefore, it is not surprising that we find ourselves in a situation where the importance of different processes (e.g. phenotypic plasticity and micro-evolution) are being discussed, but no consensus has yet emerged. Theoretical modelling may help us to get a better idea about the selection pressures involved in adapting to climate change and to know what to expect. However, as several of the contributed papers have pointed out, what we also need are more individual-based data and clever experiments to reveal the relative importance of the range of processes affecting how climate change shapes the timing of biological events, and consequently, the distribution and abundance of organisms.

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# A New Conservation and Development Frontier: Community Protected Areas in Oaxaca, Mexico

**David B. Bray, Elvira Duran, Salvador Anta, Gary J. Martin and Fernando Mondragón**

**Photo: David Barton Bray**

Most protected areas in the world are inhabited by people. Recent figures suggest that around 11.5% of the global terrestrial area is under some form of protection but about 90% of these protected areas are in IUCN categories III-VI that allow degrees of human presence and use. In addition, some 11% of forests globally have been devolved to local communities to varying degrees by governments. Thus, the vast majority of protected areas in the world have human presence in them, although frequently with unclear rights to forests and their products when they are present.

Mexico is at the forefront of countries where local communities have direct ownership rights of their forests, with an estimated 56-80% of national forests directly owned by communities, within which extraction activities are regulated by Mexican environmental law. This process of devolution occurred as a result of a sweeping agrarian reform that took place through most of the 20th century. One outcome of this devolution has been that Mexican forest communities have gained decades of experience in managing their forests for the commercial production of timber. A recent study suggested that an estimated 2300 communities have commercial logging permits with varying degrees of vertical integration and sustainable forest management.

However, not all Mexican forest communities have commercially valuable forests and others have forest areas that are mostly inaccessible. Further, the dominance of community ownership of rural lands means that there are few opportunities for expansion of Mexico's public protected areas that do not conflict with pre-existing community ownership. These realities have led some communities to become pioneers in taking advantage of a new policy opening from the Mexican government, the possibility of officially recognized protected areas on community owned lands. According to government figures, 34 community protected areas have been recognized by the National Commission of Natural Protected Areas (CONANP) since 2003. Of these 34, 13 are in indigenous communities, and 12 of these 13 are in the state of Oaxaca, with several clustered in the Sierra Norte region. Further, a recent study by one of the co-authors and his colleagues found that Oaxacan communities are, in addition, informally protecting 236 'voluntary conservation areas' (an area of about 240,000 ha). The authors, in

varying combinations, have been supporting community efforts and conducting research in a subregion of the Sierra Norte known as the Chinantla for many years. The Chinantla region is home to the Chinantec indigenous peoples. The Chinantecs have resided here for at least a thousand years and have historically been isolated and marginalized. Our present work is with six Chinantec communities that have a total population of 2,039 inhabitants. The communities together occupy an area of 33,921 ha, with some of the largest intact tracts of montane tropical forest and cloud forest anywhere in Mesoamerica. These forests were first described by Mexico's most distinguished botanist, the Polish-born Jerzy Rzedoski, and are well known for their unique floristic associations and endemic species.

The community of Santa Cruz Tepetotutla, the only one of the six communities which is accessible by road, has emerged as the leader of a six-community organization, the Natural Resource Committee of the Upper Chinantla (CORENCHI). The micro-political history of Santa Cruz is of particular note. This community has spent most of its many centuries in existence far from the nearest road, achieving direct communication with the outside world only in 2003. Since the 1980s, there have been intense micro-political struggles amongst different factions in the community over land-use policy connected to varying economic interests. More recently, this has led to the emergence of new conservation-oriented institutions and rules.

In the 1990s a coalition of community reformers rose to dominance in the community. This group had been inspired by its association with ecologists who had conducted vegetation surveys in the region, and by other factors, and began to push for very conservation-oriented community land-use policies. As a result of this process, new regional management institutions are beginning to emerge, and a remarkable portfolio of sustainable land use practices and projects has been assembled. In recent years, some community members have made the transition to growing organic coffee and have banned hunting except for pest animals that attack their corn fields. Four of the communities have been certified by the government as placing over 20,000 ha of their lands in community protected areas, with additional areas in the other two communities in the process of certification. They also successfully competed for a Mexican government program for payment for hydrological services for the period 2004-2008 that covers 7,860 hectares. The National Forestry Commission (CONAFOR) also recently approved a 5-year renewal of the hydrological services program for nearly 1.5 million dollars for the six communities of CORENCHI. In addition, CORENCHI is also in discussions over hydrological service payments with Mexico's largest brewery, which depends on water generated by this watershed; the brewery is also currently co-financing the construction of a research and ecotourism center in Santa Cruz.

CORENCHI has received significant support over the years from several non-governmental organizations, the Oaxaca-based NGO, Geoconservación, currently being the most important. Among other alliances, Geoconservación has recently joined with the Interdisciplinary Research Center for Integral Regional Development (CIIDIR-Oaxaca), Florida International University (FIU), and the Global Diversity Foundation, to conduct research, build capacity, and carry out training projects in support of CORENCHI's efforts to sustainably and profitably manage the lands they have protected.

With funds from the U.S. Fish and Wildlife Service granted to Geoconservación, the CIIDIR-FIU program is currently working with students documenting the history of how Santa Cruz came to adopt remarkably conservation-oriented land use policies, analyzing community attitudes towards wildlife, carrying out camera-trapping surveys of wildlife, particularly jaguars and their prey, and studying potential habitat for jaguars. It is also beginning studies of interactions between emigration, land use, land-use and land-cover change, vegetation mosaics and landscape ecology.

The Global Diversity Foundation (GDF), a UK-based charitable organization, has received funding through the British Embassy in Mexico to build local capacity to manage the CORENCHI community conserved areas. Under the program, which is part of the UK government's Sustainable Development Dialogues, British and Mexican specialists will offer training for community members on the sustainability of non-timber forest product extraction, scientific tourism, participatory video, and legal frameworks for community conservation. The effort will foster collaboration between local people and outside researchers at the community biological station and refuges that are being established. One result of the project will be participatory biodiversity registers that will assist communities to defend their traditional resource rights and to identify plant resources of potential economic value. Selected community members will be able to broaden their experience by participating in cross-visits with other communities in Oaxaca that are also working on community-based conservation and scientific tourism.

We will be exploring the issue of establishing a carbon sequestration project in voluntary markets in this region. Under the Kyoto Protocol, the forests of the Chinantla, although of great value for a variety of ecosystem services, do not qualify for carbon credits because they are both intact and unthreatened due to community protection. Under current Kyoto rules, carbon credits can only be given for "additionality", i.e., new forest plantings, or, possibly in the future, for "avoided deforestation" projects that reduce the risk of deforestation.

The forests of CORENCHI, the larger Chinantla region, and others like them throughout Mexico and elsewhere present a challenge for the world community. Here we have intact forests with high biodiversity value, which are owned and actively protected by poor indigenous peoples. Yet these people are being told that the forests have no value in terms of carbon maintained in standing stock, because of the requirement of additionality and avoided deforestation. This is a situation of carbon storage and biodiversity protection being provided free of charge by poor rural people, and raises issues of environmental justice in the context of carbon markets. This case underscores the need for more creative thinking about mechanisms to collectively address global warming, forest and biodiversity conservation, proverty alleviation, and environmental justice. One possible response is that of receiving payment for 'environmental services' for the protection of the region's unique biodiversity or payments for 'pure preservation' now being developed by the Chicago Climate Exchange. The communities of the Chinantla of Oaxaca, through their own efforts and the efforts of outside supporters, have placed themselves in a leadership role in forging solutions to these and other dilemmas of the emerging planetary crisis.

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# Parks and Poverty: The Political Ecology of Conservation

## William M. Adams and Jon Hutton

In 2004, the government of Ethiopia moved 500 people out of the Nech Sar National Park in the south of the country, before handing it over to be managed by the Dutch NGO, African Parks. The following year, African Parks signed another contract to manage the Omo National Park. The issue of evictions in these parks quickly became the subject of intense lobbying by international human rights NGOs. Such problems have been reported from many countries as the area protected has risen, doubling in the 1970s, 1980s and 1990s. By 2005, over 100,000 protected areas (PAs) covered more