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NOTES FROM THE FIELD

Mountain Agriculture at a Crossroads? Understanding Household-level Decision-making in Rapidly Changing Socio-economic Contexts

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1. AGRICULTURAL INNOVATIONS, ALTERNATIVE LIVELIHOODS AND “RESILIENCE”

We have been implementing an action-research program in 30 villages of the Darjeeling Hills (North Bengal). These villages are scattered around the borders of two significant protected areas, Singalila National Park and Senchel Wildlife Sanctuary. Our over-arching research questions have been: What impact is the changing climate currently having on rural life and economy, and what can be expected in the near future? To answer these questions, we have gathered data on agricultural productivity at the household level over five years. But we have also wanted to understand what options there might be for increasing rural resilience and adaptation to changing conditions; so we have supported interventions in several simple but useful agricultural technologies. These include polyhouses to protect delicate crops such as chillies and leafy greens; bee boxes to increase and systematize honey production, and to support pollination services;

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mushroom production; and training in soil management technologies such as vermiculture, terrace management, and the use of cover crops and organic pesticides. We have sought to help forge market linkages for new products where these were lacking, and to support villages interested in building community enterprises in eco-tourism and educational tourism.

We are aware that many of these innovations tend to communicate a vision of “resilience” that is in some sense “conservative”. Strengthening village agricultural economies, encouraging investments in soil management for the long term, advocating for the importance of healthy soil microbiota, thinking in terms of future climate scenarios — these interventions tend to reinforce concepts of village food security and the continued relative independence of village economies.

Yet, as the rural road network extends into the hills and vehicular traffic increases, there is a parallel, and in some sense opposite, regional trend toward market integration and urban-rural *interdependence*. As the pace of socio-economic change accelerates, possibilities open up that were previously closed to many rural communities: easier market access, better education, off-farm employment opportunities, etc. A widening range of life choices naturally produces a revaluation of previously-accepted aspects of daily life.

Consequently, a family’s priorities may rapidly shift away from the size and quality of the household harvest. Even if a household still considers itself fundamentally a farming household, within a few seasons the effort put into the strenuous work of farming may be reduced. Low-productivity portions of land may be abandoned. Ripening crops may be less vigorously defended against the intrusions of wild animals. The availability of local alternatives to smallholder agriculture raises the opportunity costs of continued farm work. How then should we expect people to respond to our interventions?

As in any sample of communities, household-level data show wide variation in individual responses. Some of the more entrepreneurial-minded adopt the new technologies and push them forward to strengthen their agricultural base. Others see smallholder mountain agriculture as a “losing game” in competition with the cheap food-stuffs trucked up from the plains. The result is a rapid overall turn toward reduced investment in smallholder agriculture, and a growing emphasis on non-farm income and mixed livelihoods.

However, when asked in surveys *why* they are reducing farming, many respondents emphasize *environmental factors* — especially human-wildlife conflict (HWC) and climate change. Villagers say both of these have been intensifying over the last 10-15 years. But these perceptions coexist with the

transformative regional economic trends described above. Are environmental changes *actually* driving current economic choices? Or on the other hand, are rapidly changing values and opportunities the main determinants of livelihood choices, despite the discourse emphasizing climate and HWC?

2. AMBIGUOUS TRENDS IN HUMAN-WILDLIFE CONFLICT

It is challenging to verify that HWC is in fact increasing, and if it is, when the increase started. In these villages, we know that earlier generations regularly set night watches to prevent crop attacks during harvest seasons. This shows there must always have been pressure on crops — understandably, since fields of ripening crops close to forest edges would always have represented a uniquely rich nutrient source for animals.

Already in some of its earliest issues, the environmental journal *Down To Earth* (DTE) reported complaints of increasing HWC. For instance, in January 1994, Amit Mitra published a piece describing the problem in a hilly area of Pune district (Mitra 1994). He quotes a tribal farmer: “All 25 households in my village have been affected and more than half our crop has been destroyed.” As early as 1987, formal research on the subject had already been carried out in the area: “A sample survey of 25 hamlets in the area revealed that 412 farmers had been affected and 96,000 kg of food grains were lost that year.” And these villagers seemed quite certain about the *cause* of increased depredation by wild boar: it was the new Bhimashankar Wildlife Sanctuary (gazetted 1987) and the attendant ban on hunting.

In 1998, another report in DTE (Anonymous 1998) described tribal community distress in Parambikulam Wildlife Sanctuary, Kerala (established 1973). This article referred to the “same old story of crop-raiding, as the wild animals destroy whatever is planted in the little land they have”. Just how old was this “same old” HWC story in 1998?

Across much of India, there seems to have been an inflection point in the early-to-mid-1990s when published HWC reports become more numerous. This inflection point is correlated in time with the establishment, throughout the 1980s, of many new Protected Areas (PAs). From fewer than 200 in 1980, the total number of PAs in India leapt to nearly 500 by 1990 (ENVIS n.d.). These PAs imposed strict bans on hunting and forest livestock grazing.

Although currently somewhat taboo in India, it is recognized across the globe that without large populations of top predators, fast-reproducing

herbivore populations in PAs tend to expand explosively (e.g., Massei *et al.* 2014). A clear corollary of this ecological reality is that PA management must assume responsibility for controlling these populations – both for social reasons and for ecological ones. Disproportionate expansion of herbivore populations can only have destabilizing and degrading effects on the reserve’s ecology, endangering its value both as habitat and as national heritage.

As today’s debates about the systematic culling of fast-reproducing, depredatory mammals become increasingly contentious (Arockiaraj 2015; Choudhary 2016; Chakravartty *et al.* 2016; Balachandran 2016), it is easy to forget that already in the 1980s, environmentalist Anil Agarwal and researchers at the Centre for Science and Environment were pointing out the necessity for a systematic approach to population control of wild boars and other depredating species (Mitra 2015).

Our own research on crop raiding in Darjeeling hills shows that there is relentless pressure on forest village crops from wild boar, muntjac, porcupine, black bear and macaque. The losses are greatest among the households that depend most strongly on agriculture, plant the most and thus have the most to lose. We are experimenting with combinations of fencing types, but the effectiveness of any fencing method depends crucially on long-term maintenance and also on village micro-geography. Large villages on steep, irregular terrain with dense surrounding forest are probably impossible to fence effectively. In such places, the best currently available defense against crop raiding is, in fact, to reduce the investment in crops. Thus, when viable livelihood alternatives emerge, the opportunity costs of continuing to pursue agriculture rise exponentially and many households contemplate leaving agriculture entirely. Isn’t this a social cost India’s PA system should be considering in its management plans?

3. LOCAL VARIABILITY IN CLIMATE CHANGE IMPACTS

What about climate change? We know that the Himalayan range is experiencing rapid changes. But these trends are extremely complex and variable across the region. High-relief terrain, deep and steeply-carved valleys produce extreme rain-shadow effects. Variable soils and substrates can create conditions of drought due to run-off even in high-rainfall areas. For instance, South Sikkim district, just across the Rangit River valley from Darjeeling, receives an average of 1625mm of precipitation annually – generous in the larger scheme of things, but only half of Sikkim’s maxima (e.g., Gangtok, 3494 mm). Yet even within comparatively tiny South Sikkim, there is great variability: the edges of the district receive more than

2000mm annually, while Namchi subdivision in central South Sikkim is considered a “drought-prone region”. Even at a single location, annual rainfall may vary from some 750mm in July to none at all in December. Communities situated high atop ridges, far from the perennial rivers below, depend on hill-side springs for fresh water. Springs depend on groundwater recharge processes, which in turn depend not only on quantity of rainfall but also on timing and intensity. Thus, if an average or above-average quantity of rain falls during a monsoon month, but is restricted to relatively few days of fierce rainfall, much of the water will run off the surface, leaving negligible recharge. Given this high degree of local spatio-temporal variability, attributing outcomes to climate change in the Eastern Himalaya is very tricky.

In summary, the two most often-cited environmental pressures on agriculture in Eastern Himalaya are complex and difficult to measure reliably. They are occurring in tandem with fast-moving, multidimensional socio-economic changes. Decisions on livelihoods and resource use are being made within an unprecedentedly fluid social context. We must be circumspect in attributing such decisions to any single driver, and we should not expect surveys to tell the whole story.

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