ASSESSMENT TOOL / MODEL **Community perception of land use and ecosystem service changes in peri-urban areas**

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Peri-urban areas change with time. Different (age) groups of people are likely to perceive these changes differently. Here, a method is presented to create insight in these differences. First, remote sensing data is analysed to map the changes, then qualitative data is collected through community meetings. The mapping exercise along with the qualitative data collection thus helps the researcher in finding out the trade-offs and synergies between different ecosystem services as preferred by the community.

NOTE An example of this tool in use is included as a case study at the end of this learning material.

Overview

Integration of participatory tools and free access satellite images can engage local communities in discussion about changes in ecosystem services. Such tools help to quickly map changes in peri-urban areas (urban change-spots). Linking the ecosystem services and the changes in the peri-urban areas can be a valuable first step for integrating ES-based management of peri-urban areas. Participatory tools like transect walks, qualitative mapping and Focused Group Discussions help in understanding the preferences of the communities.

Relevance of the level of analysis

Cities are witnessing unprecedented growth of population and increase in urban sprawls mostly because of a drive by the government targeting higher economic growth. With changes in the ecosystem services it is important to understand the perception of the communities towards these changes and integrate them in management of peri-urban areas particularly with respect to food and water. The heterogeneity in the preferences and the interdependencies within a community needs to be accounted for while developing actions plans.

Model/tool description

The approach consists of two main processes – (i) Mapping exercise and (ii) qualitative data collection.

Mapping exercise

This involves use of remote sensing images from different years to identify the change spots. Freely available remotely-sensed imagery from NASA/USGS Landsat satellite (http://landsat.usgs.gov/) can be

used to generate the land use land cover maps of the concerned cities. As the first step of pre-processing, the downloaded bands are stacked in order to generate a composite image followed by calculating Top of Atmosphere (TOA) reflectance. With the availability of the 15m resolution panchromatic band, Landsat 7 and 8 satellite imagers are pan-sharpened to produce images at higher (15m) resolution. Subsequently images are clipped where the clipping area is determined by the 30km buffer ring which is centered within the city center. Object Oriented Classification (OOC) method available in the IMAGINE Objective module in Erdas Imagine 2015, is used to classify pan-sharpened images. The Classification and Regression Trees (CART) model available in Salford Systems Data Mining and Predictive Analytical Software (http://www.salford-systems.com/) is used to generate land use land cover (LULC) classifications. Following the generation of all the land use-land cover maps, the thematic change detection analysis is conducted using ENVI software package version 4.8 (Exelis Visual Information Solutions, Boulder, Colorado). This will result in the indication of land classes that has been converted temporally into other different land classes spatially and statistically as well.

Qualitative data collection

From the spatial-temporal maps, sites are selected for studying the perceptions of the different communities on the different ecosystem services linked to the changes detected in land use land cover. Use of participatory tools in understanding the perceptions of the community members residing near to the change-spots through transect walks, FGDs, participatory mapping and KIIs.

The mapping exercise along with the qualitative data collection thus helps the researcher in finding out the trade-offs and synergies between different ecosystem services as preferred by the community. The mapping exercise reveals 'which' ecosystem service has changed over time for a specific area and community. The qualitative in-depth interviews and transect walks answer 'who' has benefitted and 'what' are their preferences/trade-offs in the ecosystem's services over development and 'how' well-being is impacted.

Details for potential users

Proposed users - Researchers, urban planners, policy makers, and local governments
Key actors/stakeholders/beneficiaries - local authorities (urban planners) preparing plans for interventions with food and water resources as an important consideration
Model input - maps and qualitative data
Model output - qualitative understanding of the ecosystem changes and the preferences
Time period for different steps of model use and analysis: Temporal remote sensing images (usually 5 years interval is preferred over two decades or more)

Key terms

- **Change spot analysis -** the process of indication of land classes that has been converted temporally into other different land classes spatially and statistically as well.
- **Transect walk -** a group exercise which entails walking across the intended community area exploring environmental and social resources, conditions and systems by observing, probing and discussing with community members
- **Qualitative participatory mapping -** a group based qualitative research method to generate a map of the area covering different land use, resources, infrastructure and utilities with minimal intervention from researchers. The mapping process generates an understanding of the connection between people, places/spaces and resources within the community over time.
- **Focused Group Discussions (FGDs) -** A FGD is a qualitative tool which involves interviewing a small number of demographically similar people of a community over a specific topic of interest.
- **Key Informant Interviews (KIIs) -** KIIs are qualitative in-depth interviews with (using semi-structured questionnaires or checklists) people having a knowledge about the community. The purpose of KIIs is to collect information from a wide range of people on specific topics in more in-depth, including community leaders, professionals, or residents—who have first-hand knowledge about the community.

Key references

Avinandan Taron, Chandima Subasinghe and Pay Drechsel. 2017. Community perception of land use and ecosystem service changes in peri-urban areas of four South Asian cities. Unpublished case study / manuscript. International Water Management Institute (IWMI), Colombo, Sri Lanka. A full case study description can be found here and for a summary set of slides please refer to this file (version with audio available here).

Case Study - Community perception of land use and ecosystem service changes in peri-urban areas of four South Asian cities

Time period (or an indication): 4 months
Key actors/stakeholders/beneficiaries: Urban Planning, community members and decision makers

Applying the model: In these cities, one of the main drivers for the changes was the government pursuing a policy of city based economic growth through the promotion of employment creation, IT parks and industrial hubs. This resulted in public land acquisition with land prices rising exorbitantly in surrounding areas. This resulted in conversion of agricultural land, wetlands, open spaces /barren land into built-up through private and public intervention leading to loss of agricultural produce, livestock and groundwater depletion.

The community members living in these urban change-spots reported about eutrophication of lakes or drying up of smaller water bodies, accumulation of waste and loss of open spaces. To the older population

living in these vicinities, the loss in provisioning ecosystem services matter the most. However, since the young population has not noticed the contrasting changes in the ecosystem, regulating services are more significant. Similarly, the perceptions about the socio-economic losses as reported by the older population were different from that of the younger generation. The increase in dependence on markets for food, inequality between income classes with reduction in livelihood opportunities for the marginalized class, and women being more affected with the changing livelihood patterns were highlighted by the senior community members. There were contrasting perceptions of the younger generation who could adapt to the changing socio-economic conditions. To them, an increase in civic amenities, infrastructure and diversified employment/livelihood opportunities is what they look for in the cities. Thus the case studies reveal trade-offs for ecosystem services and economic growth as well as synergies in the use of the services overtime and how the preferences for such services might differ within a community. The reasons for changes in the ecosystem services can be different across different cities and hence this becomes a first step towards understanding the community preferences, their trade-offs and/or synergies with ecosystem services in growing urban sprawls of South Asia and elsewhere.

Lesson learned - Participatory tools, and intertemporal analysis of remote sensing images, are suitable approaches to understand changes in ES based on community perceptions. Such tools can be used to quickly map and prioritize ES values in peri-urban areas. This can be the first step towards integrating ES-based management of peri-urban areas. Different generations have different preferences for ecosystem services. Their perceptions about the ecosystem changes and the related socio-economic variabilities differ. Therefore, valuing the ecosystem services over different generations to derive the trade-off would help in further enhancing ES-management in peri-urban areas.

Recommendations - The methodology stated above is self-sufficient in creating a narrative towards explaining the trade-offs and synergies between ecosystem services and economic growth. It provides us with an understanding of changes in well-being but by 'how much' also needs an answer for peri-urban planning. The qualitative setup is thus a first step towards such a planning process. However, a rigorous planner might seek quantification of change and integration of values based on socio-economic perceptions, which they require to support decision-making processes. Therefore, the need for the tool to be developed is to pin down the trade-offs and synergies in ecosystem services and its uses and provide evidence for incorporation in the planning process.

Questions for reflection:

1. Will quantification of the ecosystem services help in finding trade-offs?

2. If quantitative tools are used for valuation what tools/methodology can be used to sharpen the approach?

To hear the perspective of the author on these questions, please refer to this recording.