World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Spatial analysis as a basis for enhancing environmental service and sustainable development

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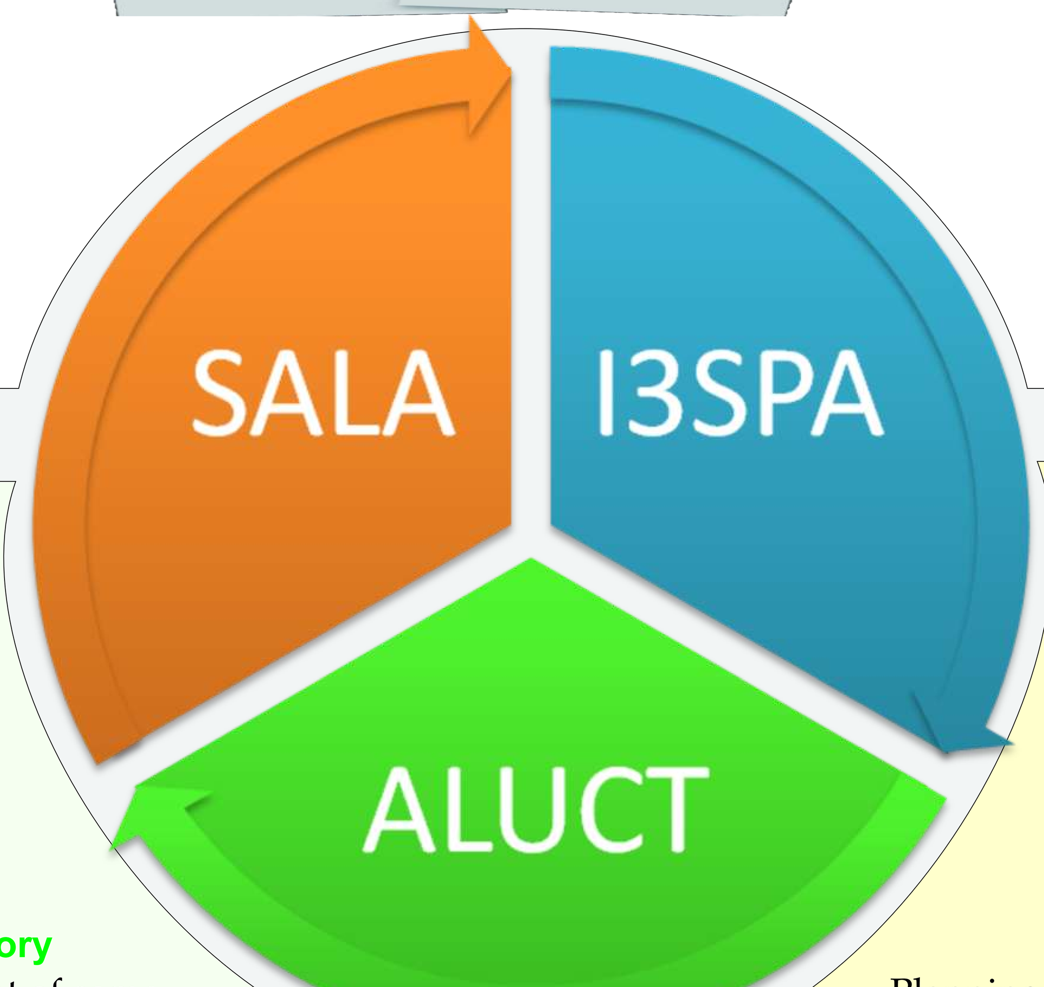
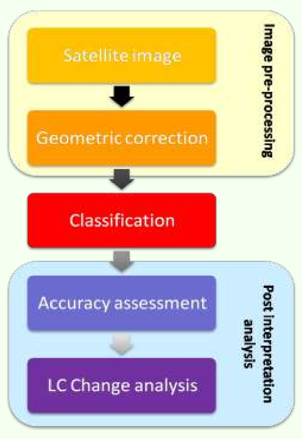
SALA
SPATIAL ANALYSIS FOR LANDSCAPE ASSESMENT

A landscape is a large enough contiguous area which is dynamics in space (x, y, z) and in time (t). Landscape as a unit analysis is defined not independently from the objectives of a study. In assessing a landscape, one needs to cover the continuity over the landscape to understand the landscape configuration and landscape transformation processes. Four main functionalities of SALA are to assess and quantify: (A) **the flow and relationships among elements** of the landscape represent landscape transformation processes, (B) **the landscape spatial dynamics**, i.e., the variation, pattern and composition within the landscape, (C) **the landscape temporal dynamics**, i.e., the changes in the landscape from time to time, and (D) **the spatial autocorrelation** (i.e., correlation between nearby areas) due to spatially auto-correlated processes and characteristics.

Remotely sensed data are used to evaluate land cover based on the appearance of land surface in one particular time. Specifically designed sensors can generate data that are used to derive elevation maps, hot spots, wind direction etc. The scope of SALA embraces land use/cover change and trajectories (ALUCT) and spatial planning for sustainable development (I3SPA). Basically for the environmental services for sustainable development application, remotely sensed data are the sources of time-series land cover maps, of which environmental services in the forms of watershed protection, biodiversity maintenance and climate change mitigation are strongly related with. A set of base maps that is aligned with the remotely sensed data is necessary as additional data to interpret the remotely sensed data, to quantify temporal changes in the same location, and to combine the land cover maps with other factors to quantify and qualify environmental services and livelihood provision. For more specific application, further modeling and analysis are often necessary. SALA produces the main data input for other TULSEA series, i.e., RaBA, RaTA, RaCSA, RHA, DriLUC.

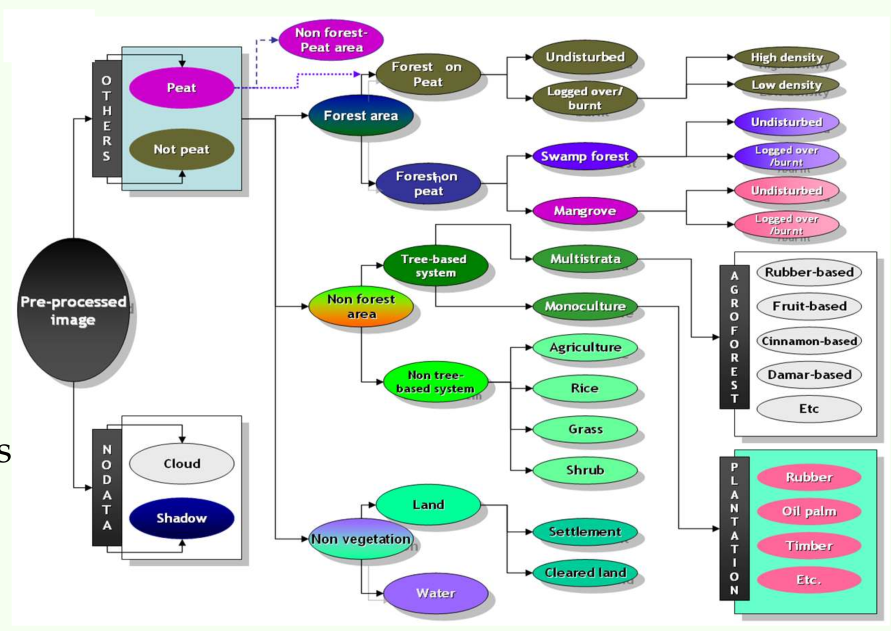


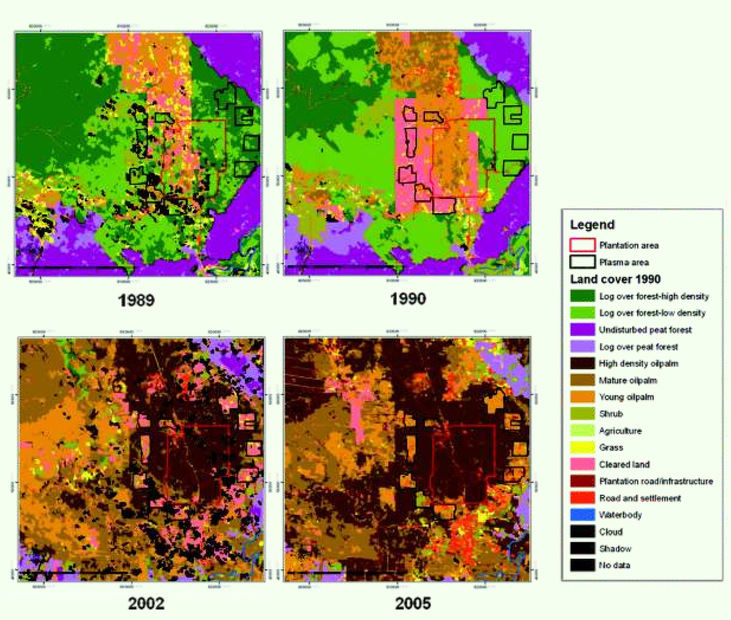
ALUCT
ANALYSIS OF LAND USE/COVER CHANGE AND TRAJECTORIES



Analysis of Land Use and Cover Trajectory (ALUCT) is an important part of assessment of some environmental services aimed by several of the TUL-SEA Tools, including the **RACSA**, **RHA** and **RABA** (rapid appraisal of carbon stocks, hydrology and agrobiodiversity, respectively) methods. ALUCT also forms the basis of scenario studies (**FALLOW**), land tenure claim appraisal (**RATA**) and analysis of the drivers of land use change (**DriLUC**).

ALUCT involves change quantification on time-series of maps resulted from remote sensing data interpretation. **Step 1.** List dominant land use and land cover types in the landscape of interest and define legend category based on most important environmental services and drivers. This steps is of particular importance otherwise it may not be suitable for answering specific questions or addressing particular issues and lead to non-valid conclusion. **Step 2.** Select appropriates data source. Time coverage, spatial resolution, and amount of cloud cover are three main criteria used in selecting the best satellite images for any study **Step 3**. Hierarchical Object based Classification. Image classification began with an image segmentation proces Following the segmentation process, image classification was conducted using hierarchical structure s.





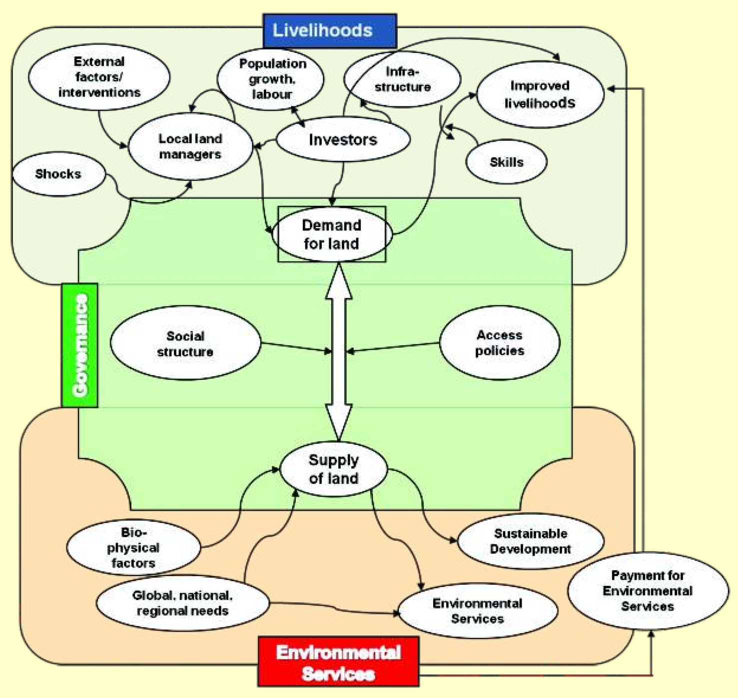
Example of ALUCT

To analyze the plantation history and associated 'carbon debt' of plantation establishment, the Analysis of Land Use and Cover Trajectory (ALUCT) method was used for two pilot areas in Indonesia on the basis of time series land cover maps produced from satellite images. Three main outputs from the analysis are:

a. Time series land cover maps from
b. Land cover change quantification
c. Land cover trajectories for the period of analysis

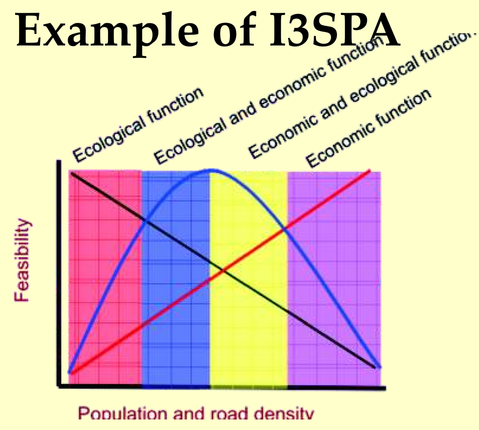
I3SPA
INFORMED INCLUSIVE INTEGRATIVE SPATIAL PLANNING

Planning is only necessary when there are set of objectives or targets within limited resources available to achieve them. Spatial planning in the context of land uses and development for achieving sustainable livelihoods in the rural area is no exception. It is of extreme importance to optimize and prioritize land use because of limited land and other natural resources, limited options to achieve sustainable livelihood objectives, and increasing needs for resources over time due to development and population growth.

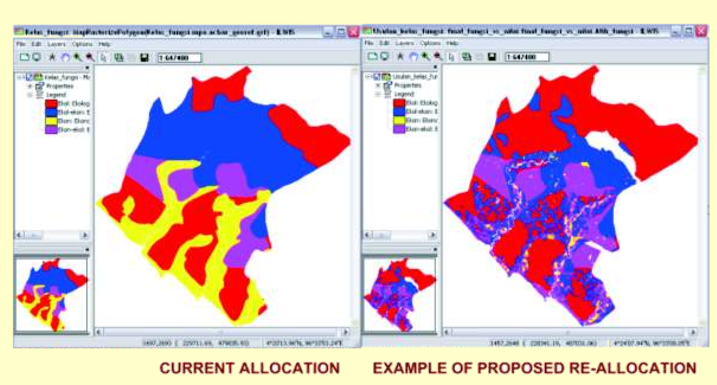


Spatial planning should be **integrative** by respecting simultaneously economic and ecological principles of land use and development planning for sustainable livelihoods. It should also be **inclusive** to all beneficiaries and stakeholders to raises the probability of success of planning and implementation. Stakeholders need to be identified, interest needs and perception among stakeholders should also be considered. Spatial planning process has to be well **informed,** it has to be based on proper and accurate data and information of past and present condition: sources of data are reliable and proper for planning purpose.

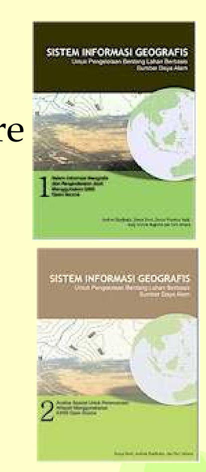
Example of I3SPA



We presents several example of I3SPA application in Aceh Barat that illustrate the integrative and informed principle and touches the inclusivity principle. The first example picks up district goverment plan to promote some export commodities. The second example present a re-evaluation of the current plan against the present situation: population growth, land uses, and enabling development factors.



We identify and learnt technical constraint in conducting I3SPA: limited capacity, expensive software data availability. To address this we published 2 books, that can be accessed through: http://worldagroforestry.org/sea/publications



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