STATUS OF DIGITAL SOIL MAPPING IN BSWM

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OUTLINE OF PRESENTATION

- Historical background on soil mapping in the Philippines
- Digital soil mapping resources
- Challenges for digital soil mapping in BSWM
- Digital soil mapping activities – past and current
- Summary and conclusion

Historical background of soil survey in the Philippines

- 1903 = the first soil survey in the province of Batangas was conducted by Clarence Dorsey
- 1934 – actual provincial soil surveys began when the Soil Survey Committee was established by then Secretary of Agriculture and Commerce
- Reconnaissance soil surveys were conducted and the soil series was the key pedological unit for mapping the soils of the province. Profile observations recorded the key characteristics of the soil series.
- Soil survey work was briefly interrupted by WWII.
- 1945 – the Soil Survey Division was reorganized

Historical background

- 1951 (June 5) – the Bureau of Soil Conservation was established.
- 1964- renamed Bureau of Soils, with regional and provincial soil districts; reconnaissance survey of the provinces completed by mid 1960's. (Varying map scales)
- The 1970's – detailed soil surveys (1:10,000 map scale) for major irrigation projects in Central Luzon, FAO-funded
- 1980's – semi-detailed soil surveys (1:50,000) of provinces based on USDA Soil Taxonomy
- 1990's – technical cooperation with JICA which extended until 2005. Semi-detailed provincial soil surveys continued.
- 2000's to present– municipal-level soil surveys through co-financing with local government.

Digital soil mapping resources

- We have Geographic Information System (GIS) and Remote Sensing (RS) facilities established in 1991 as part of the technical cooperation project with JICA. A service unit was organized to handle the soil information technology – Integrated Soil Resources Information Service (ISRIS) under the Office of the Director.
- The GIS and RS facilities – both hardware and softwares – were upgraded four times, the most recent was in 2011 under a special government appropriated Unified Enterprise GIS Project. This includes procurement of satellite images.
- We have programmers and technical staff trained in GIS and Remote Sensing.
- We have already updated our Soil Survey Manual to accommodate changes in the USDA soil survey methods and soil profile description but not yet implemented in the field because we are also yet to update our Soil Information System.
- We have also come up with manual on map standards and symbols for those into digital mapping.

- BSWM is still into classical soil survey method for routine or regular project implementation.
- Digital soil survey activities are limited to specific research projects.

Challenges for digital soil mapping in BSWM: organizational set-up

- The BSWM organization has evolved through the decades to reflect developments in soil surveys, classification, and mapping:

- One division handles field soil survey
- Another division handles cartographic services
- Another division handles land use planning and land resources evaluation
- Another division handles laboratory analyses of soil samples
- We have a separate unit that handles soil information technology and geomatics.

Challenges for digital soil mapping in BSWM: hiring moratorium

- The national government is also re-organizing the bureaucracy and there is moratorium in hiring since October 2004.
- Considering retirements and resignations, we have not been able to fill up vacant positions for more than half a decade now. We are not only depleted of manpower complement, this also upsets the system of "understudy" to prepare a junior staff as next-in-rank when a senior staff retires.
- Literally, we have diminishing number of "field hardened" and trained soil surveyors, there are also no field experienced successors to take over at any time the hiring moratorium is lifted which seems unlikely, at least for this year 2012.
- A lean, mean but efficient bureaucracy is the goal. Unlikely for all vacant positions to be approved to be filled up.

Challenges for digital soil mapping in BSWM: teaching "old dogs" new tricks

- With aging manpower complement and without new understudy to take over classical soil survey work, any new hires are unlikely to be trained and become familiar with classical soil survey, classification and mapping activities. But since GIS is now part of resource management curriculum in colleges and universities, the technical manpower market maybe tuned in to digital soil mapping works but totally unfamiliar with classical soil survey work.
- It is quite difficult to involve classical soil surveyors with computer-age technology because they are afraid to boot a computer, much more tinker with the commands. And with continuing developments and advances in information technology, even those who are initiated are often unable to keep up with the pace. There is tendency to be complacent with what we know.

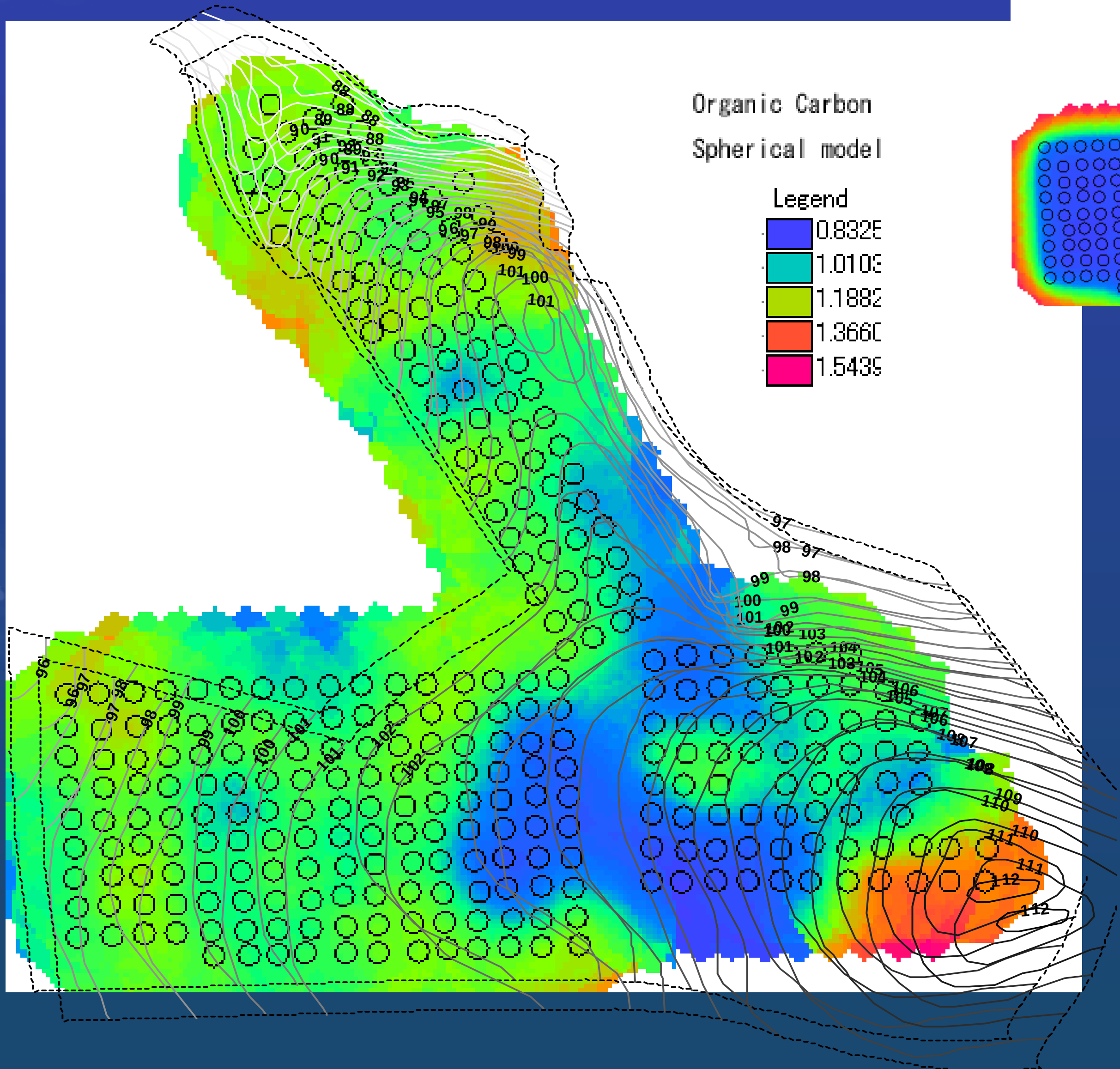
Challenges for digital soil mapping in BSWM: it is still a long way but THE only way

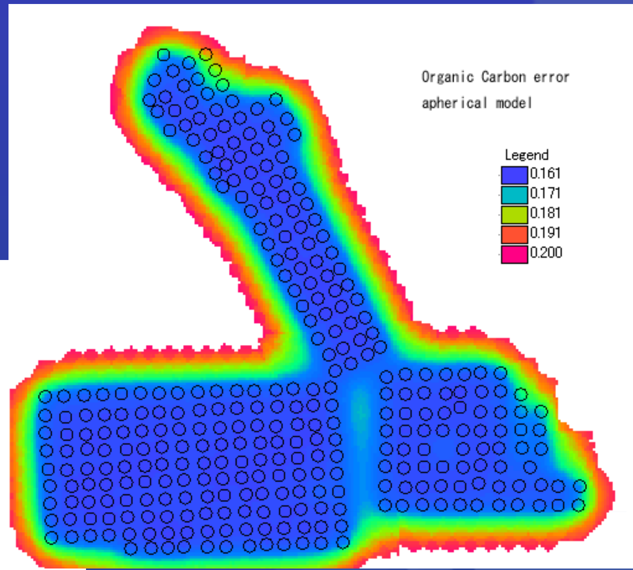
- Without understudy because of hiring moratorium, it is only a matter of time when we are totally depleted of classical soil surveyors. The labor market for natural resource management has only information-age generation.
- The demand for our map outputs are digital. Despite the fact that the soil follows geological timetable and not human timetable, we need to re-issue all our maps to conform with the demand. Currently, our maps for sales (analog maps) look more like museum pieces rather than a vital and relevant information source for various applications in agriculture, architecture and engineering, and environmental sciences especially for those dealing with rural development planning, research, and policy.

Past digital soil mapping activities: geostatistics

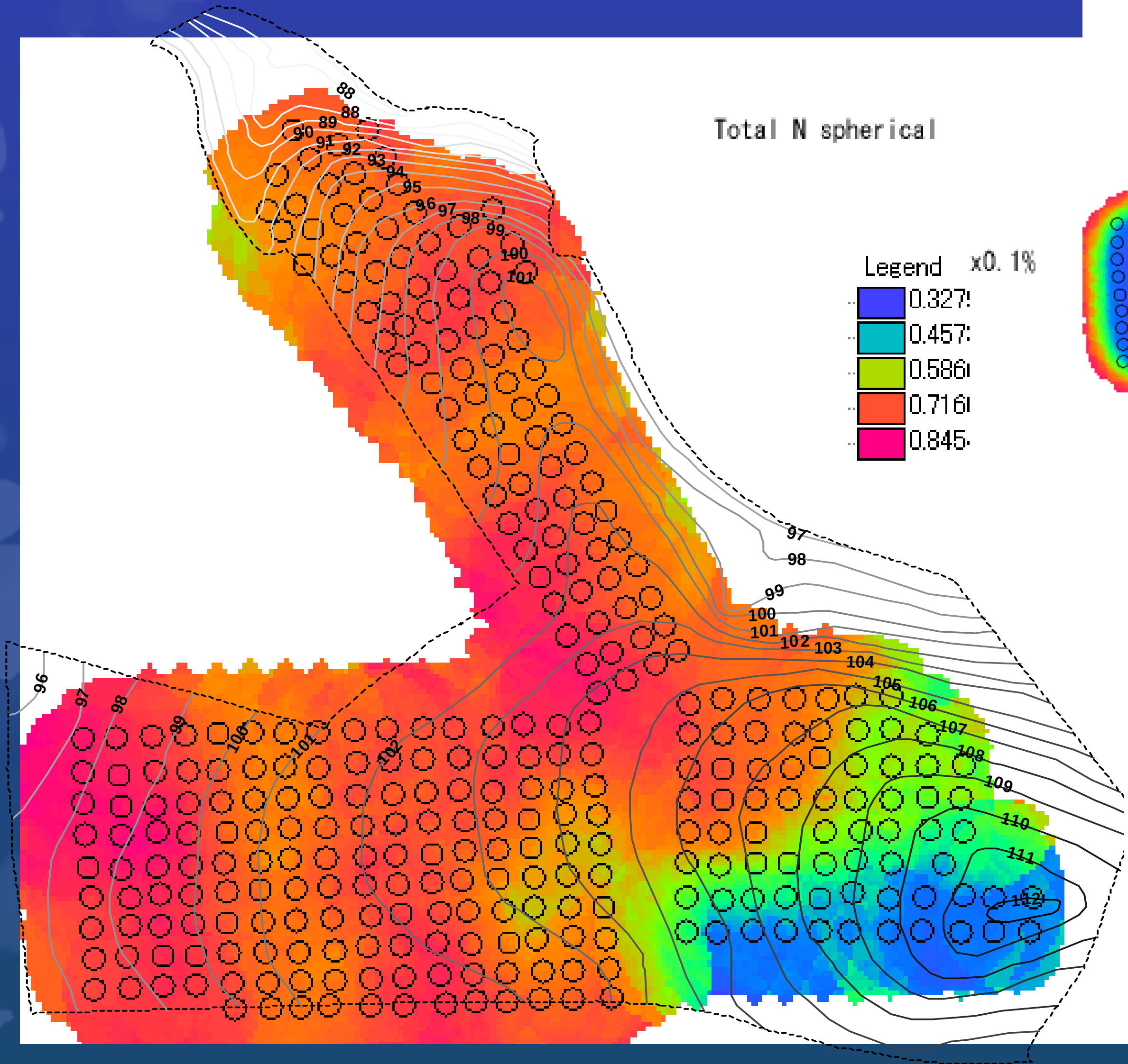
- We have done geostatistical interpolation as early as 1993 using GEOEAS software and MS-DOS (286-based) computers for Cavite province at 4.25 km x 4.25 km spatial variabiity analysis and mapping.
- By 2005, we did catenal variability of soil properties using ILWIS on Pentium IV for a JICA-funded techno-demo farm. A total of 313 soil samples were collected in grid and analyzed.
- Today, we have Corei5 and Corei7 computers and ArcGIS10, ILWIS, and ENVI. But this is done on request basis, not as routine because of implications on number of samples for laboratory analysis and the increasing cost of laboratory chemicals.

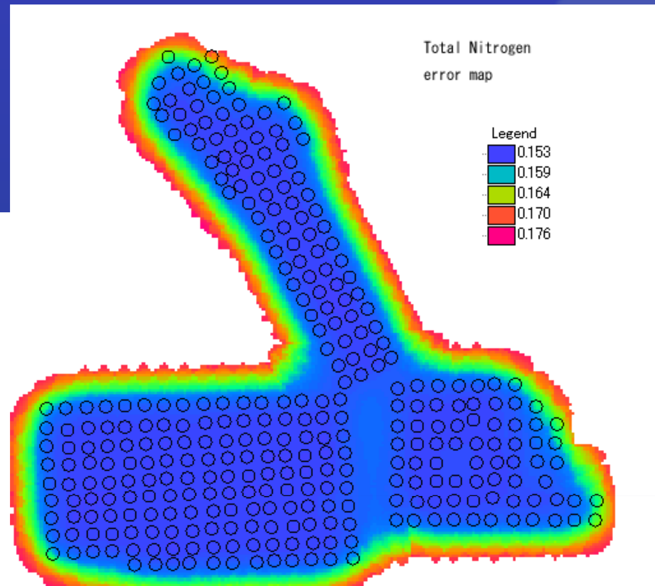
Organic carbon map



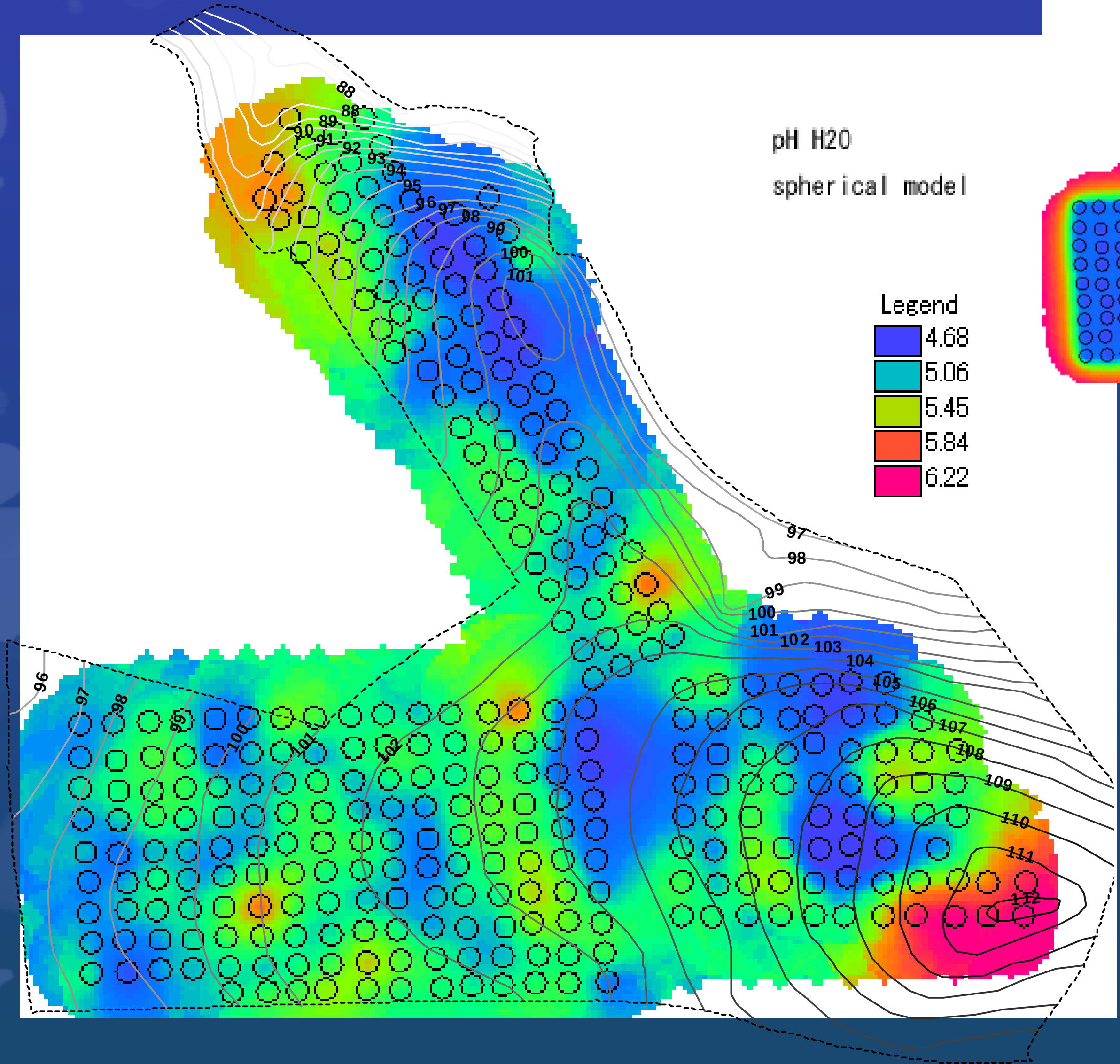


Nitrogen map

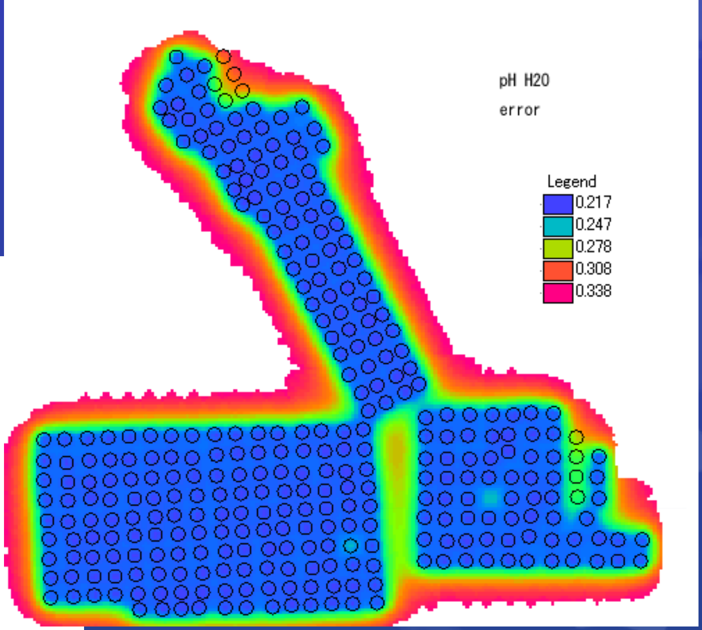




Soil pH map

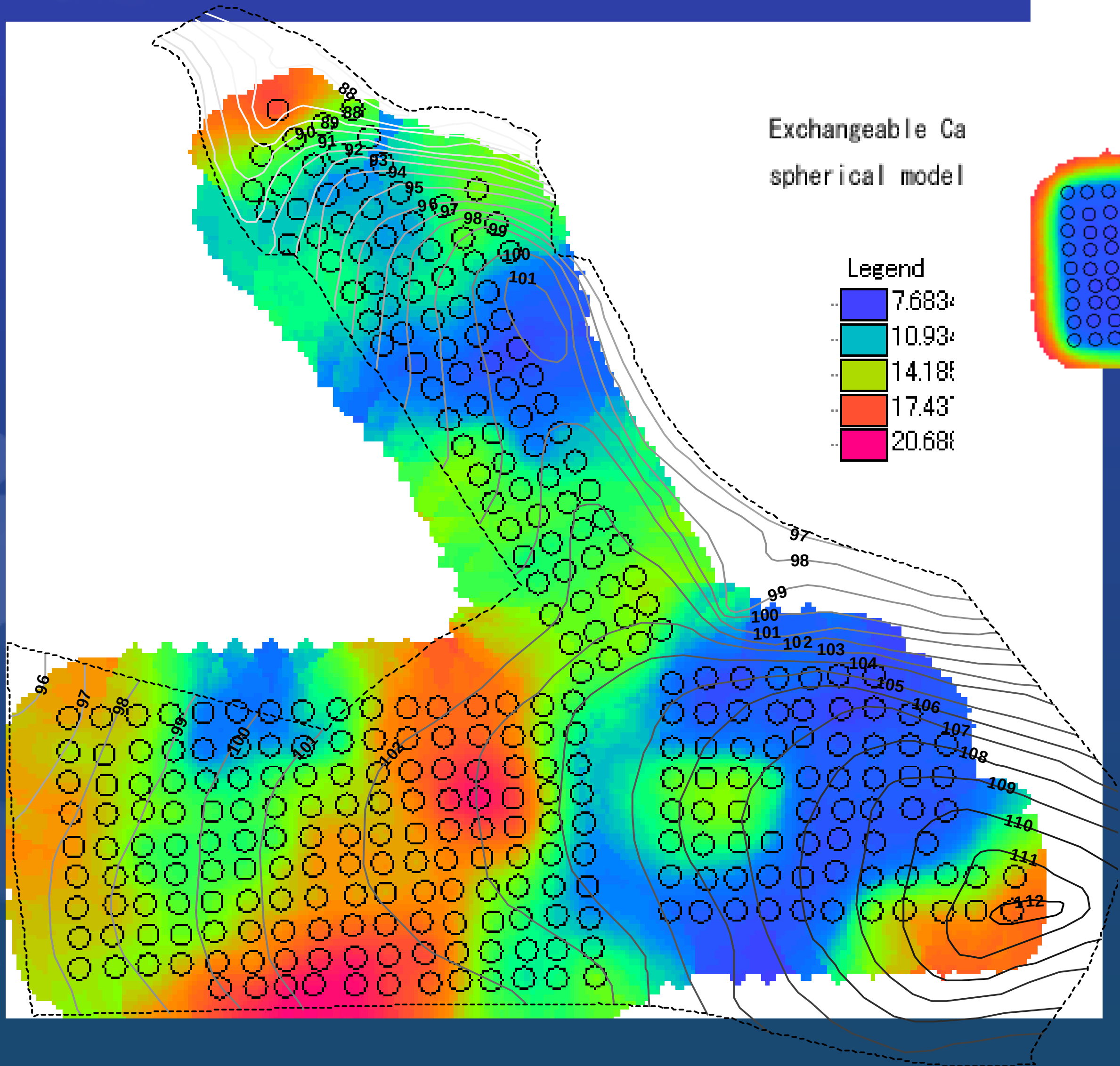


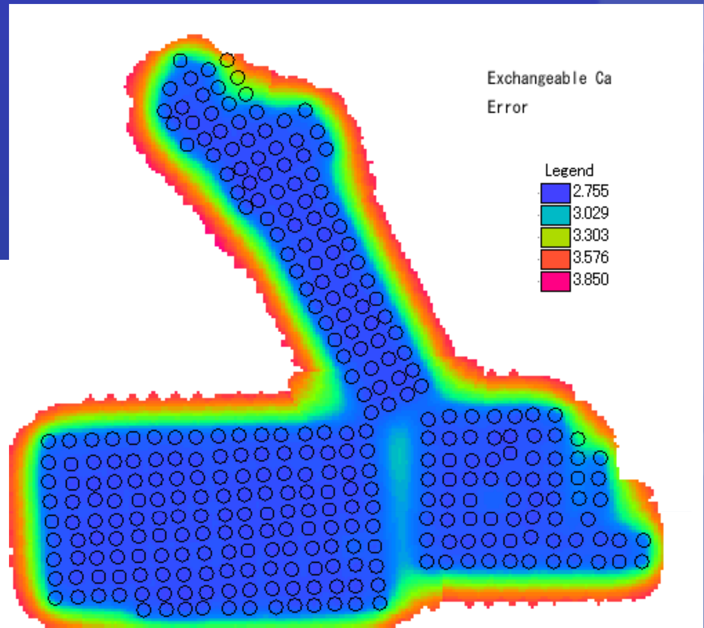
pH H2O
spherical model
Legend
4.68
5.06
5.45
5.84
6.22



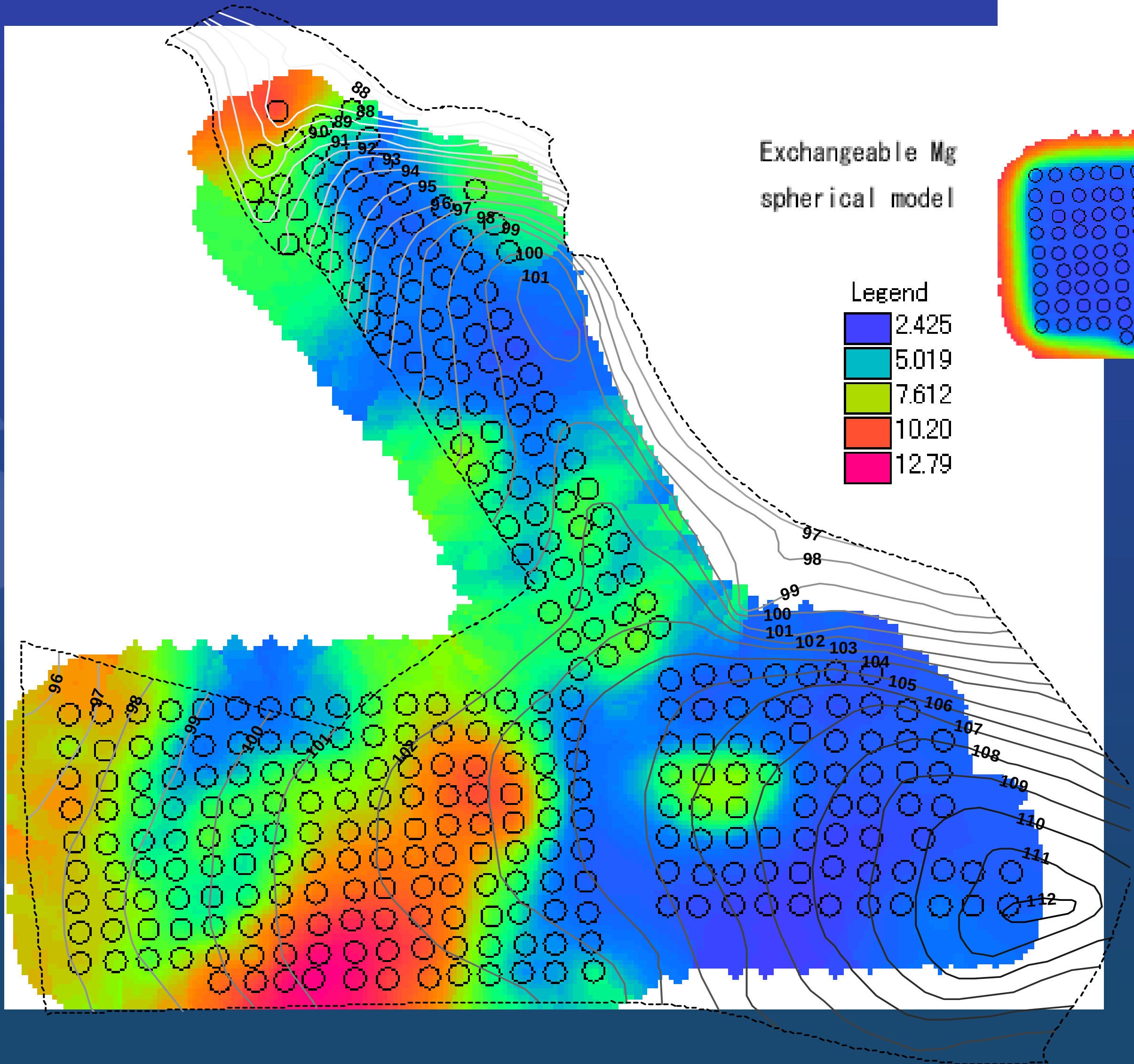
pH H2O
error
Legend
0.217
0.247
0.278
0.308
0.338

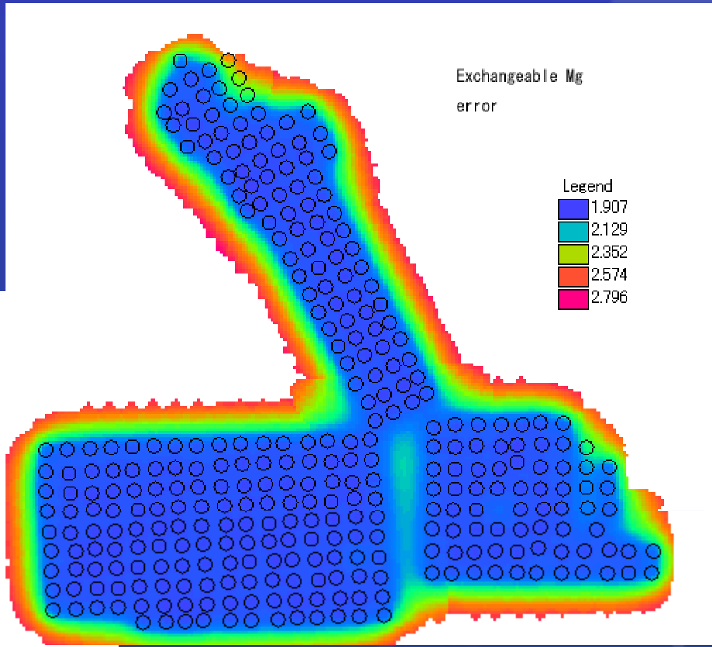
Exchangeable Ca map



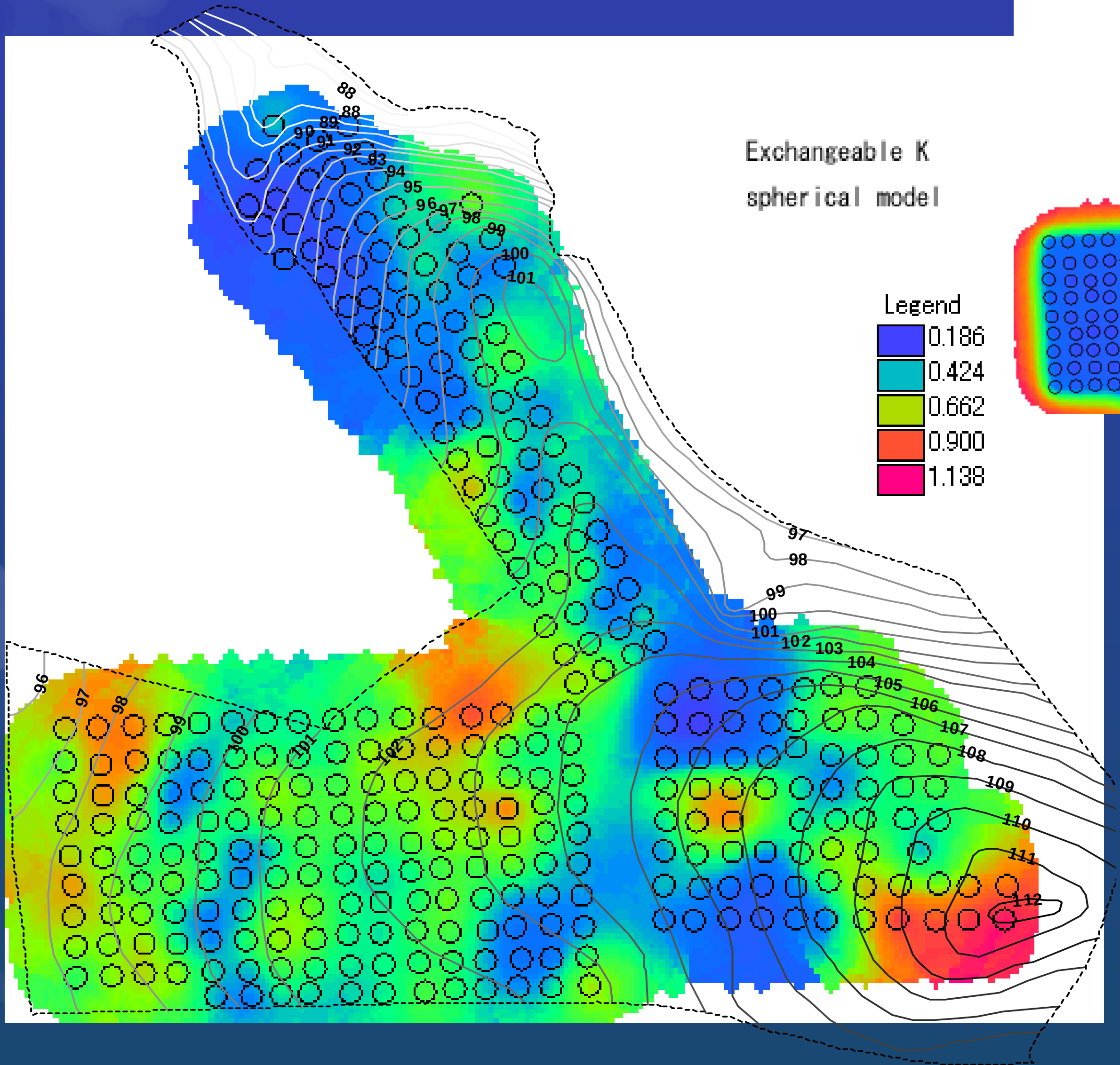


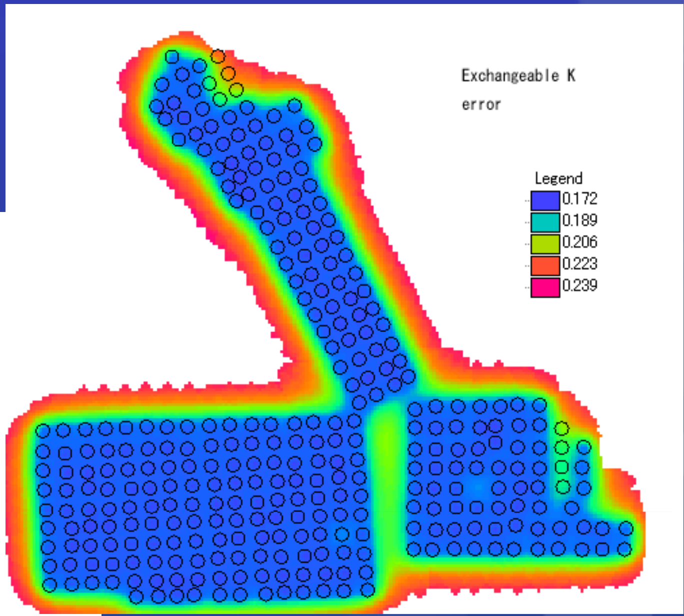
Exchangeable Mg map



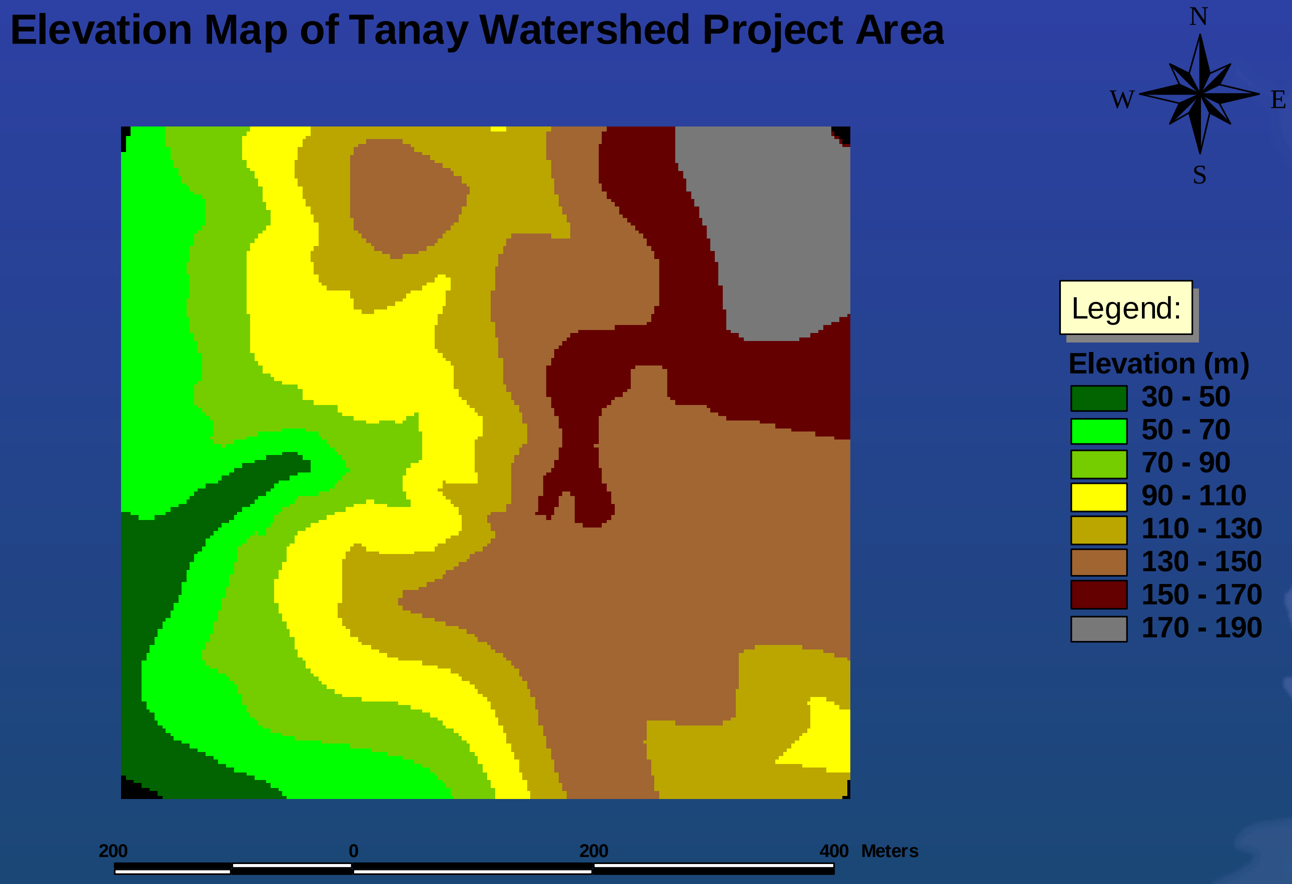


Exchangeable K map





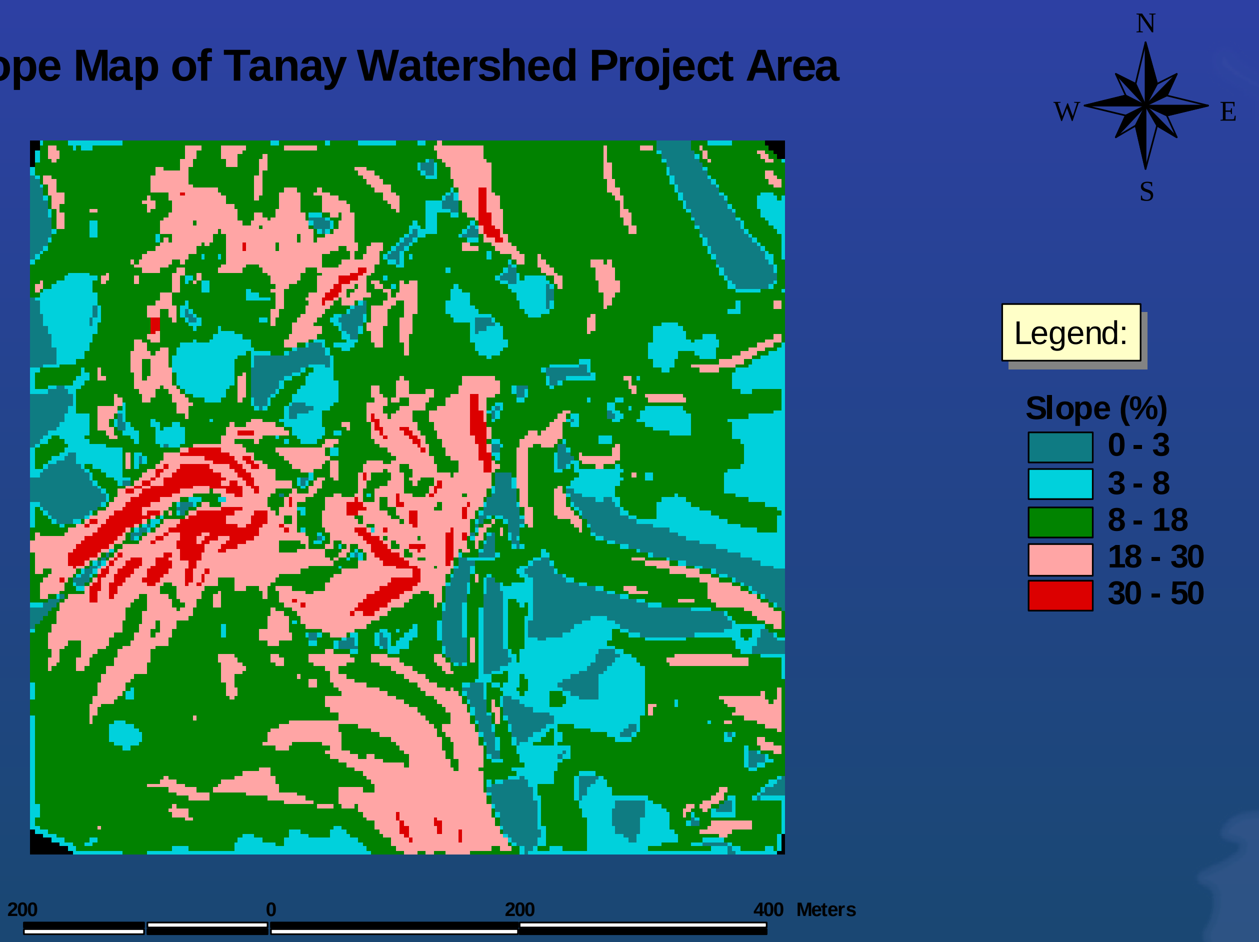
Past digital soil mapping activities: thematic mapping



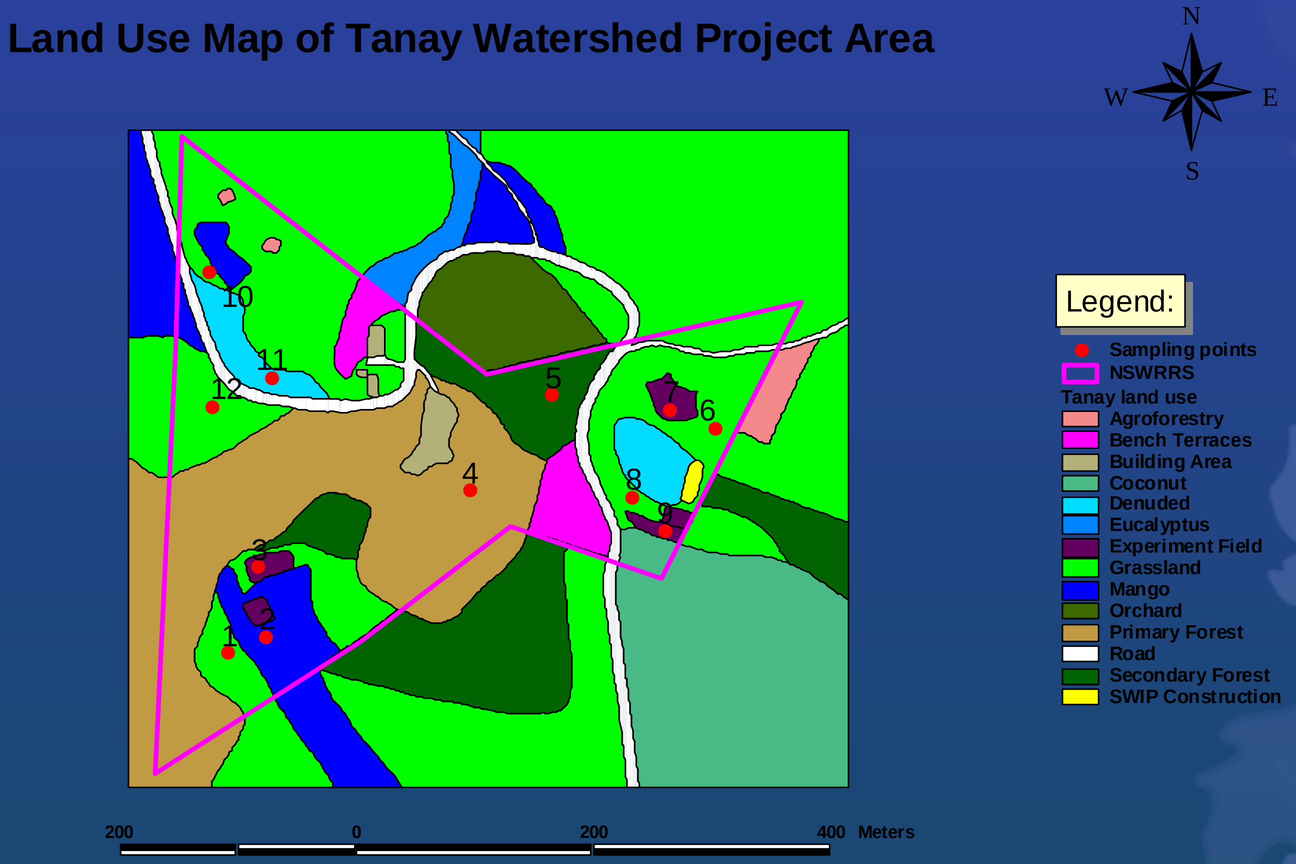
Slope map of Tanay, Rizal watershed

Slope map

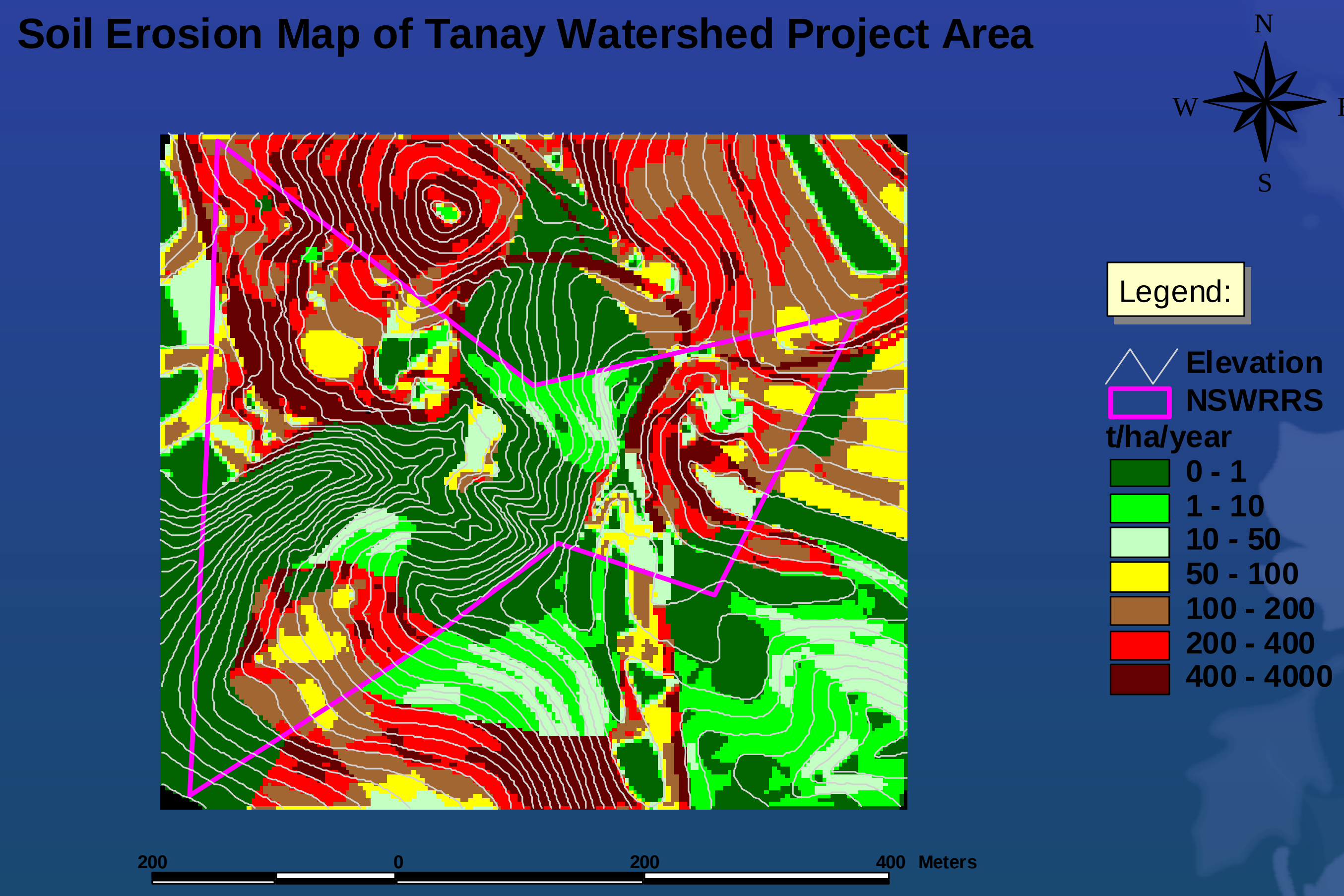
Slope Map of Tanay Watershed Project Area



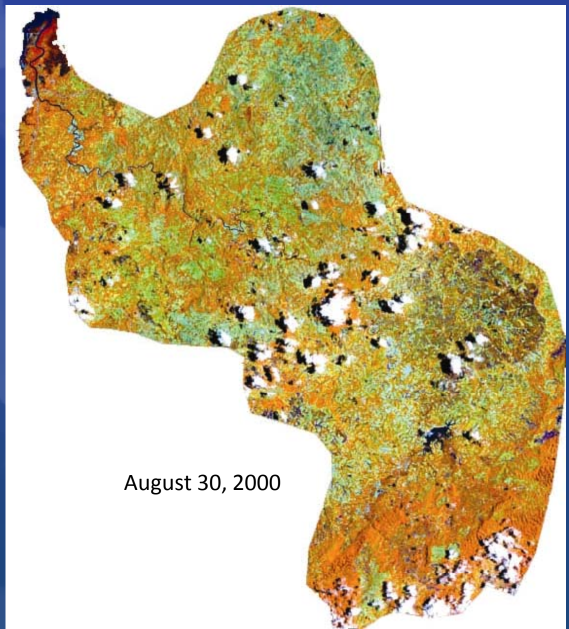
Land use map overlayed with project boundary

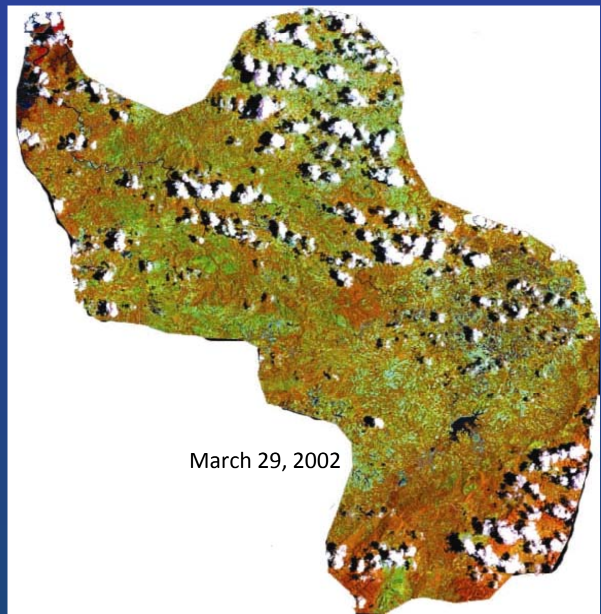


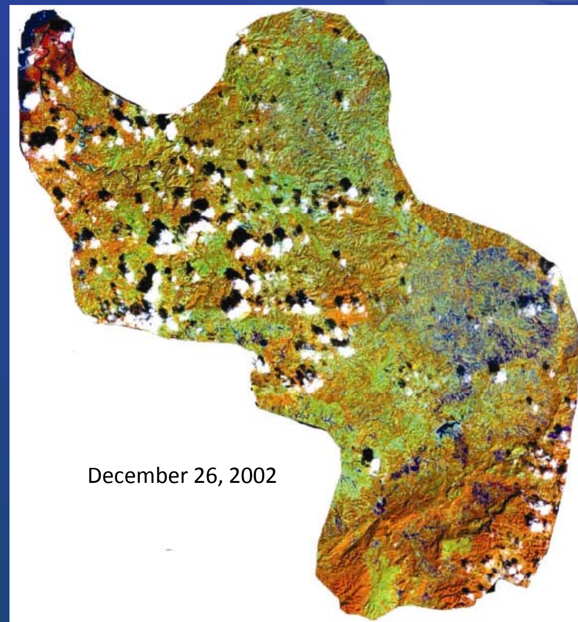
Soil erosion map overlaid with topography



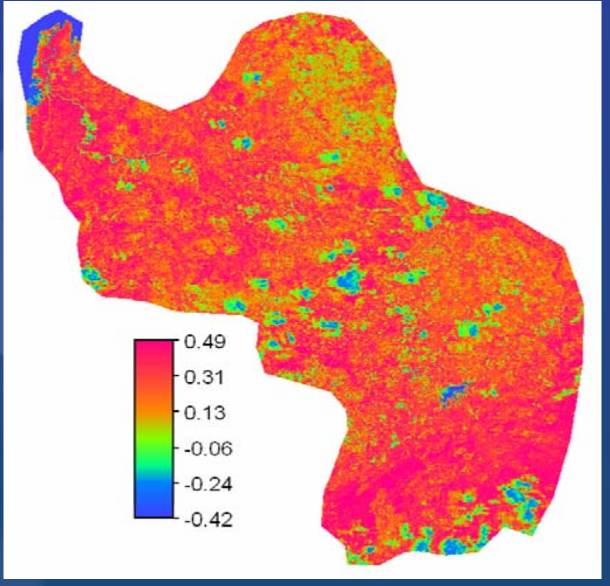
Landsate7 ETM+ false color composite subsets, Inabanga Bohol Watershed



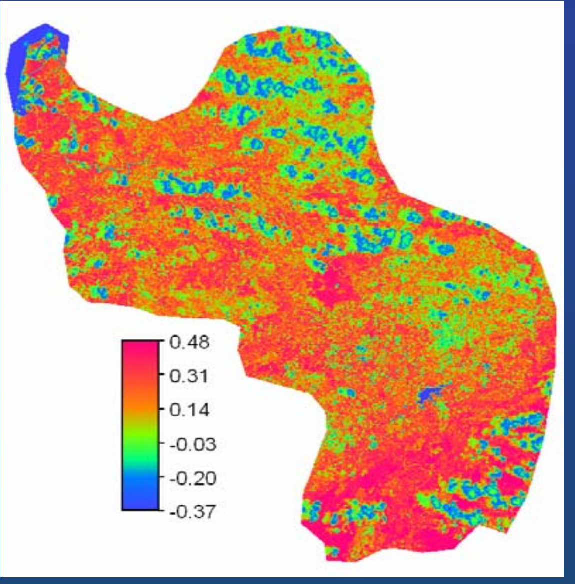




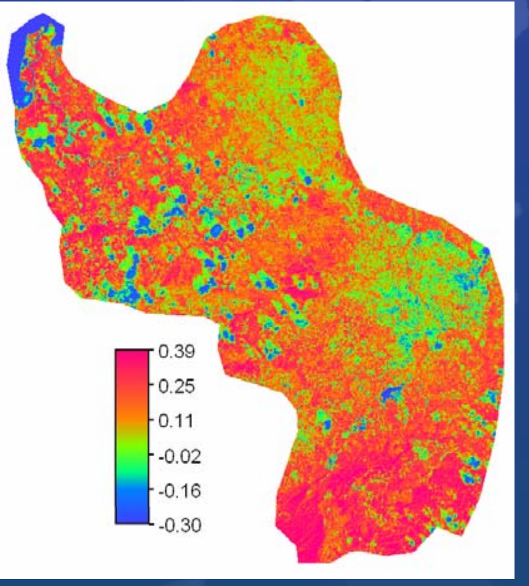
NDVI for the multi-temporal Landsate7+ ETM subset



August 30, 2000



March 29, 2002



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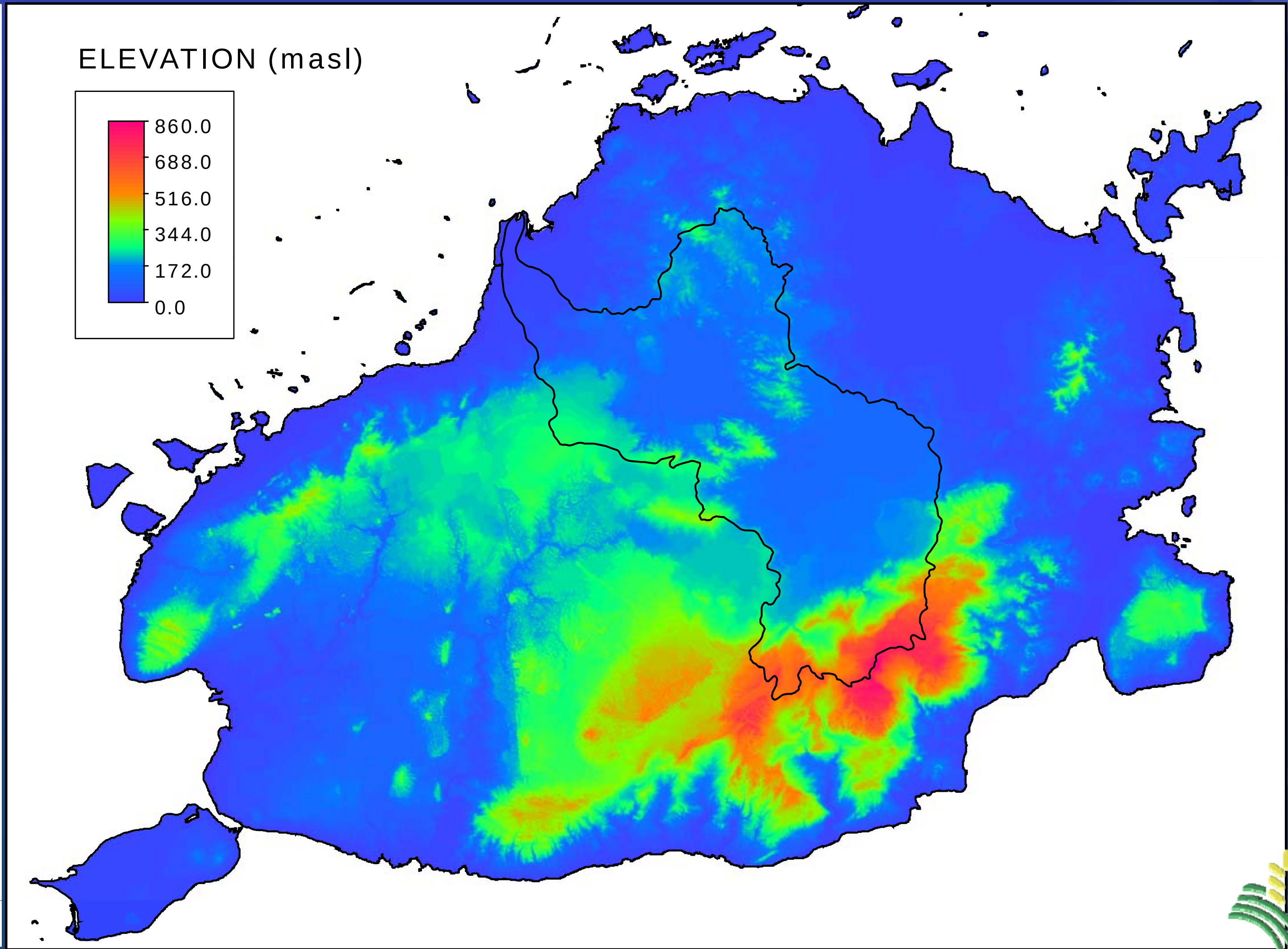
Digital elevation model



Past digital soil mapping activities: land resources evaluation

Identification of land degradation Hot Spots using ArcView 3.2 and ILWIS 3.2, Inabanga Bohol Watershed

Boundary and limiting soil attribute maps

Figure 19. The upstream sub-watersheds.

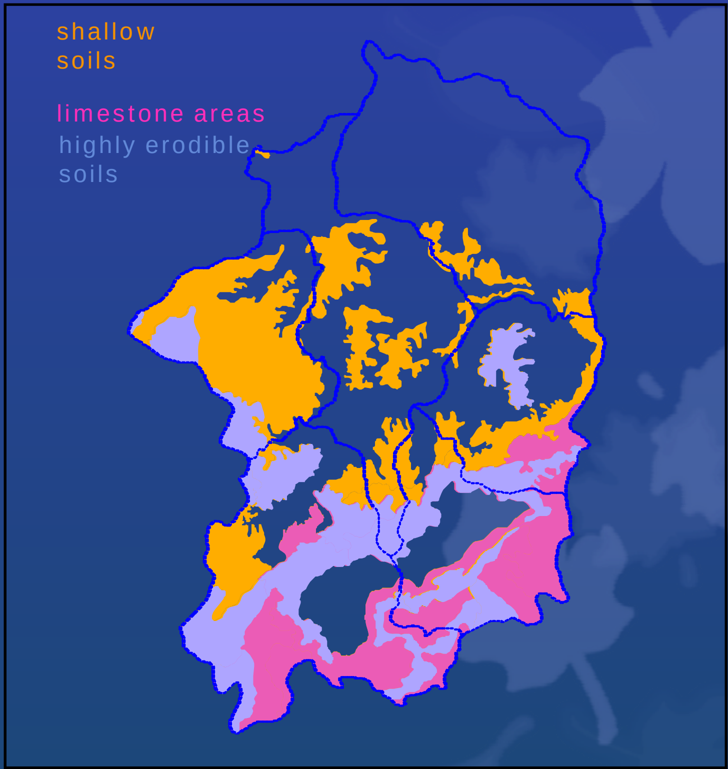


Figure 20. Combined soil limiting attributes.

Overlay with intensive agricultural use

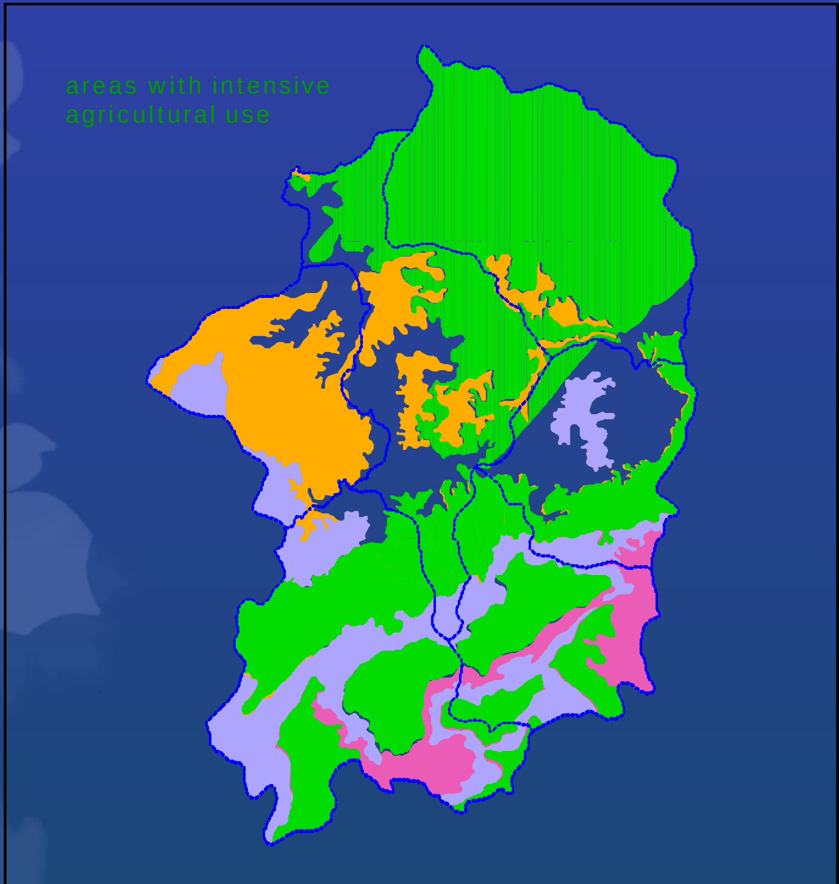


Figure 21. Soil limiting attributes vs. intensive agricultural use.

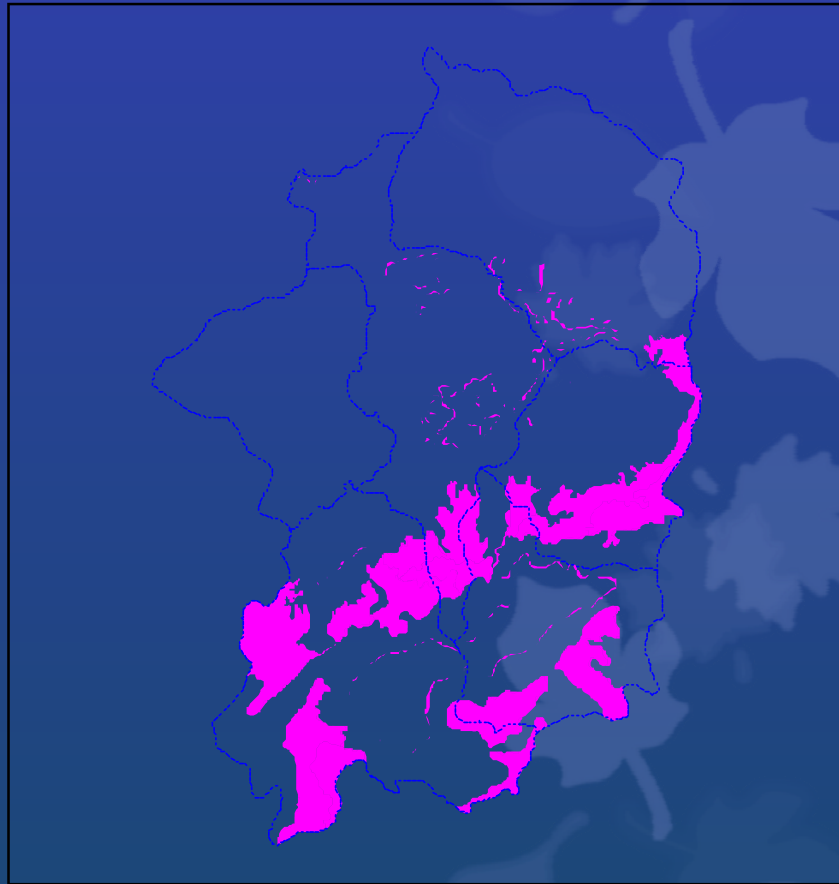


Figure 22. Result of the intersection of soil limiting attributes and intensive agricultural use.

Overlay with agricultural areas within the forest reservation → Land Degradation Hot Spots

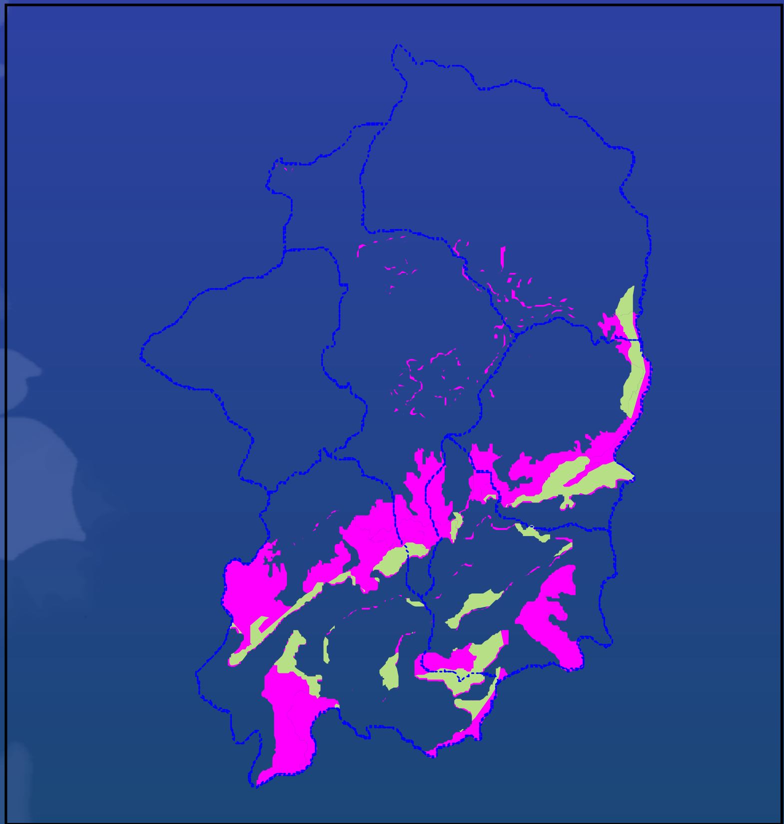


Figure 23. Intensive agricultural use with soil limiting attributes vs. agricultural areas within the forest reservation.

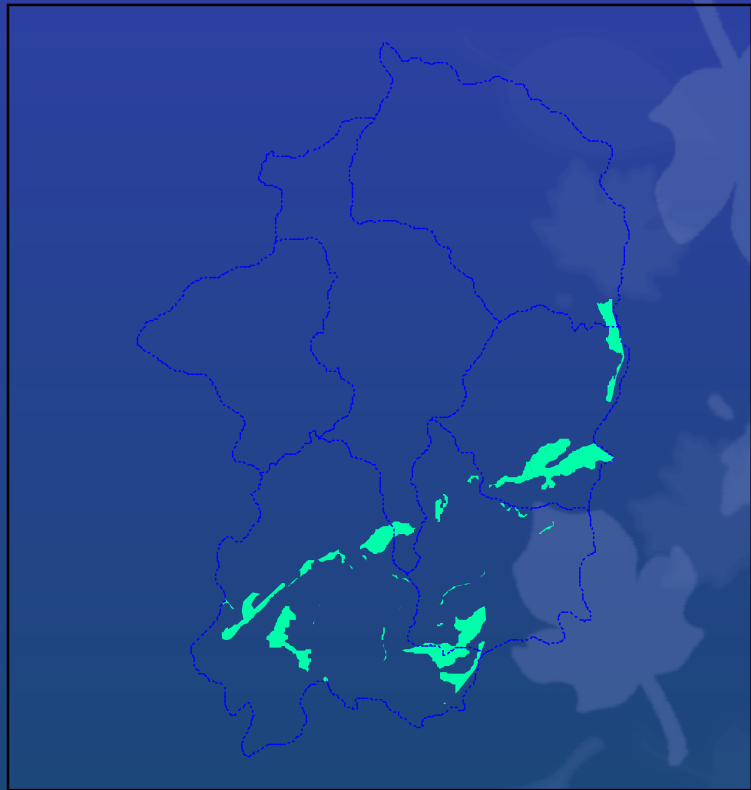


Figure 24. Result of the intersection between intensive agricultural use with soil limiting attributes and agricultural areas in forest reservation.

Current digital soil mapping activity: Mapping land/soil attributes of Cabulig, Misamis Oriental and Inabanga, Bohol watersheds using digital technology

- ACIAR-funded research project
- Reconnaissance soil survey was completed last December 2011
- Field survey work is to begin February 2012.

- The first objective is to improve the efficiency with which land attributes are mapped by using digital soil mapping techniques to produce more detailed and quantitative maps.
- Digital soil mapping (or, more broadly, digital land resource assessment) has two components. First is to develop methods of rapid soil measurement that allow quick and inexpensive (though less precise) measurements/ estimates of important soil attributes. The strategy is to make lots of inexpensive measurements rather than a few, precise and more expensive ones.
- The methods include the use of proximal sensors, such as visible/near infra-red and/or mid infra-red spectrometers, and pedotransfer functions to estimate soil attributes. These methods still require the use of conventional laboratory and field measurements on a proportion of sample locations, to provide local calibration.

- The second component of this objective is to improve spatial prediction of land attributes directly without the intermediate step of using soil type. This involves deriving statistical models of the relationships between land attributes (measured at point locations as discussed above) and spatial data covering the whole area of interest. Such data include digital elevation models and satellite imagery.
- Overall, the strategy is to adapt digital land resource assessment techniques to the conditions in Philippine upland watersheds to provide maps of land attributes with better utility and at lower cost. This will give a more complete picture of a watershed when combined with other data from rapid appraisal including land use and socio-economic information.

Current digital soil mapping activity: Preparation of Land Use System (LUS) Map for land degradation assessment

- This is a FAO-LADA funded project. LADA refers to set of land degradation assessment methodology developed for drylands. We are testing the applicability of methodology for monsoon country like the Philippines.
- This is a multi-agency collaborative project with BSWM as lead agency.
- The final project output is Land Use System Map of the Philippines.
- The status – we are in the process of refining the LUS Map as we just acquired the spatial data sets from our project partners.

Current digital soil mapping activity: Updating of our Strategic Agriculture and Fisheries Development Zones under the Unified Enterprise GIS Project

- The project involves acquisition of satellite imageries.
- Once the satellite imageries are processed, we would overlay our Strategic Agriculture and Fisheries Development Zones to assess changes since 1998.
- We also intend to re-issue all our map outputs based on these orthoimages.
- Current status – the satellite imageries are on bidding state and we are awaiting Notice of Award to winning bidder and the delivery of the images.

Summary and Conclusion

- We are still in classical soil survey.
- We have the resources and manpower for digital soil mapping but these are undertaken at research or project level, not as a routine activity.
- Considering labor market for technical staff and the retirement of our soil survey experts, though we are still a long way to digital soil mapping, it appears to be the only way.
- We are grateful to FAO and to the Organizing Committee of this East Asia Node of DigitalSoilMap.net for inviting us to participate in the launching of this partnership.
- We look forward to fruitful years ahead of us.

Thank you and good day!