

**GlobalSoilMap US Consortium Meeting**  
**Morgantown, West Virginia, USA**  
**May 09-10, 2012**

**Location:**

**West Virginia University Division of Plant & Soil Sciences**  
**1108 Agricultural Science Building**  
**Morgantown, WV 26506-6108**  
**Meeting Room 1011 Ag Sciences (Armentrout Study)**

**Participants:**

West Virginia University: Jim Thompson, Travis Nauman, Katie Bucklan, Aaron Burkholder, Bill Waltman  
USDA-NRCS-NSSC: Jon Hempel (remote on the telephone), Thomas Reinsch (remote on the telephone)  
Dave Hoover, Sharon Waltman Tom D’Avello Zamir Libohova  
Purdue University: Edwin Winzeler  
USGS-EROS: Norman Bliss

May 09, 2012 - Morning Session

**8:05 - 8:30 - Introductory remarks**

Goals and expectations for the meeting:

- Develop roadmap for how to finish version 0.1, the STATSGO2 product;
- Develop a plan for finishing SSURGO and STATSGO2 based products so we can move on to more advanced products;
- Plan for 0.5, the SSURGO-driven product;
- Discuss serving the data to the public;
- Discuss strategies for getting user feedback

Several remarks and comments related to the goal of the meeting and beyond were made:

*Jon Hempel* – we will have resources available at the center and WVU to get the versions through the system and ready to be served; but quite a few questions remain – such as:

- How to build the database; we can get into the specifics of that later this morning;
- if we can concentrate on version 0.1 and learn from that we can apply the methodology to the SSURGO product next

*Sharon Waltman* – folks at Columbia have some specifications for databases

*Jim Thompson* – not sure how much progress Wilson’s group has made toward developing a working data model

*Jon Hempel* – We don’t have a data model at this point.

*Dave Hoover* – we are at a point where we already have; we will become more enmeshed in GSM in the future; we are undergoing a lot of raster development at this point; we are heavily involved in the disaggregation process; we are undergoing a large initiative called the soil rejoin, cleaning up a lot of the inconsistencies that become evident when we look at a national map

*Zamir Libohova* – formal specifications of the GSM are what we should use to structure our conversation.

### **8:30 – 9:30 - Overall GlobalSoilMap.net Project and the DSM workshop in Sydney**

*Jim Thompson* – 5<sup>th</sup> Global workshop on soil mapping; 130 participants were there; discussed advances in DSM with the underlying theme from moving forward from DSM to soil assessment to meet user needs and guide decision making, having relevant maps vs. static maps; the format was a cluster of 5 minute presentations; 6-8 presentations in rapid succession; about 30-45 minute discussion after the presentations; this format tends to be a difficult format to adapt to, but it can be very productive; it focuses more on discussion rather than presentation; it generates a lot of ideas; the conference offered new approaches and applications; a number of talks highlighted progress towards GSM.net products; several talks touched upon challenges and solutions; plan is that there will be a proceedings publication; harmonization and disaggregation were highlighted, uncertainty, depth functions and splines;

*Jon Hempel* – a good contingent of US people were there; P.R. Owens, Janis Boettinger, Sabine Grunewald, Nathan Odgers; 125 people total were there; DSM is not a trend or a fad, but is here to stay; people from all over the world, including Iran, Denmark, Tunisia, Nigeria, S. Korea; many different methodologies were presented; a tremendous amount of advancement was on display at the meeting; we are on a path to get serious about DSM in the US; good discussions of disaggregation; US is well represented and developing a good level of expertise; good keynote presentations; a talk on the OneGeology program, which is attempting to stitch together existing geology maps across the world in one format; in a few years we should be able to do a similar thing with soils; DSM technology is the means of producing soil information in many parts of the world; what we are doing with GSM should be a model for the standards and specifications that the NCSS adopts.

#### Standard and metadata discussions

*Jim Thompson* – the standards for GSM.net are product standards, not methods standards; GSM.net has tried to avoid developing standard methods

*Jon Hempel* – that's a good model for the NCSS too; we have tried to apply one standard method, but specific methods don't work everywhere; a standard for products is good to have

*Sharon Waltman* – there is a place for both methods standards and documentation standards; important not to confuse the two; but both are needed

*Jim Thompson* – there can be multiple standard methods used to meet product standards;

*Norm Bliss* – documentation is part of the standard

*Zamir Libohova* – GSM.net specifications say that documentation will specify all inputs used and the exact procedures applied to the inputs to produce all outputs

*Sharon Waltman* – while working with legacy data (in version 0.1 to 0.5), those are straightforward because the documentation has already been taken care of

*Jim Thompson* – we are developing a good contingent of University people interested in working on DSM.

*Jon Hempel* – an uncertainty conference will be put together at Lincoln, August 28-30<sup>th</sup>, Australians, South Koreans, and Europeans; GSM is pushing some of the research and development that we need to do in our program; throughout the consortium uncertainty is the one hang-up; the methodology for uncertainty will vary depending on the kind of data you have; we will try to develop a discussion that will address the issue of uncertainty;

#### Update on the GSM consortium meeting

*Jon Hempel* – we have done some work on the structure of the consortium; we are trying to build a secretariat; Neil MacKenzie has been the chief of the land and water division in Australia and a leader in DSM, has taken on the directorship of GSM project; in June he will take on the directorship full time; he will base himself out of France; he has backing from CSIRO, which will allow him to visit nodes

worldwide; the science officer, Dominic Aroyos, from INRA in France, was head of the French soil survey; he has backing from INRA for his time and travel; if we invited him to the US he would probably come in short order; he is planning to attend the uncertainty meeting; Jon is the executive secretary – sends out correspondence for the director, it is a full time job, but he can commit only about 2 hours; fund raising officer position is now vacant; we don't have any funding outside of the in-kind funding from separate institutions (such as NRCS and equivalent groups from other countries); we have a more solid structure now than we have had in the past; we have science officers and node leaders; these have been steady over the years; Mexicans and Canadians have been good partners; Mexico is very impressive and may have a data base that rivals ours; once we start working with them to produce this information it should be fairly easy to do with their data; they have an aggressive program to collect more data; no change in node leaders or science officers for 3 or 4 years; harmonization concept with different methodologies into a single data source is a goal that is attainable

*Jim Thompson* – big picture is very important; some of the other important points that came up in Sydney include interaction with global soil partnership (FAO initiative); GSM.net may get involved with GSP to develop map-based products for them; developments on the science side of things, but with Alfred and Bob leaving ISPPRA, things have been less active;

*Jon Hempel* – Russia may break off from the Eurasian node; some discussion about the Eastern Asian Node, about whether it is too big; discussion about bringing in other entities into the consortium such as the Asian Soil Science Society; there was discussion about bringing people and entities into the consortium.

### **9:30-10:00 - INEGI updates**

Teleconference with *Eliseo Guerrero and Thomas Reinsch*; they have been working on a soil map of soil depth to try to meet GSM specifications; they are working on a pilot watershed; they are making a soil map according to GSM specifications of soil depth; they have 62 soil reference points there; it is divided into 10 subwatersheds; in each watershed they are going to use the information to create splines and hope to finish this pilot project by the end of June; they are putting together a database of the attributes; they are working to see if they can get the carbon data for different depths for these soils; any questions?

*Jon Hempel* – can you explain the methodology?

*INEGI* – start with polygons and soil data and trying to extrapolate that information

*Sharon Waltman* – how large is the pilot study area?

*INEGI* – not very big

*Norm Bliss* – I have been taking the point data and the polygon data to make a component table and then on the pedon table I am building a profile data set; the existing data is like a horizon data set; I am summarizing to a pedon data set; and then I have a design for matching those two data sets together, but I have not finished doing so.

### **10:00 – 10:30 – GSM Standards and Specifications**

*Zamir Libohova* – provided a short summary of the GSM properties as specified by the current GSM specification document. Properties:

Primary: Organic C; pH; particle size (clay, silt, sand, coarse fragments); effective and total soil depth  
ECEC

Derived (used only if primary measurements are not available, data always trumps derived data)  
Bulk density (gravel excluded (coarse fragments?)); Available water capacity (mm)

Secondary  
EC (1:1 saturated paste)

Depth intervals: 0-5, 5-15, 15-30, 30-60, 60-100, 100-200,

Depth to bedrock rock and effective depth.

A discussion followed on some inconsistencies found in the GSM.net specifications in document Working Draft June 2011 RAM V11 Global Soil Map.net specifications. Norm Bliss pointed out the followings:

The AWC volumetric or gravimetric, the text does not agree with the table about mass fraction of the soil (the word definition gives the mass fraction; the table indicates that it is volume); (line 8 on page 18); we need to get the units straight and consistent throughout; in short, we need to define units for coarse fragments and make them consistent with the units described in the table definition; units of coarse fragments need to be specified consistently; the footnoting in the tables is not always correct; Norm took notes on the mistakes; moist bulk density or dry – table does not specify (which volume, the dry one or the moist one?)

Discussions followed on clarification of the standards for the products as this relates directly to the assignment of the tasks for completing the v 0.1 of the GSM for US.

*Zamir Libohova* - Uncertainty for each grid location, for each depth, point; give the 95% prediction interval (19 out of 20 observations) Minimal statements of accuracy include RMSE for point predictions by cross validation for point based methods; ISO metadata standards may need to be added to the standards statement; right now it may be left up to the node

*Sharon Waltman* - recommends consideration of ISO metadata standards for GSM; the geographic community is recommending use of this standard

*Others* - Spatial unit is the 3x3 arc-seconds. Two products: a point-based estimate at the point in the center of the grid cell; the average over a 100 m x 100 m area centered on that 3 arc-second grid; point support vs. block support Discussion of SSURGO and STATSGO2 do not provide point support or block support for grid cells used in GSM; Polygons are not considered point observations or block observations?;

*Jon Hempel* – spatially weighted mean is one methodology and is acceptable as a means to get to soil properties;

*Travis Nauman* – you can use polygon weighted mean values, but if you can do better and meet the recommended methodology of point support and block support we should try to do that, but in the future we want to be aiming for something better.

*Sharon Waltman* – but the important part is to put out the product, right?

*Jon Hempel* – yes, it is important to do that

*Jim Thompson* – the implication is not that we can't meet the specifications, but we have to be aware of the limitations of the product;

*Sharon Waltman* – doesn't the version carry some of the weight of whether the map meets the specifications for support; you can write the definition of the version so that it is clear that the specifications for support are not fully met

*Jim Thompson* – it's like the instructions for your VCR; just because it is there doesn't mean that people will read it;

*Travis Nauman* – we should get finality on our 0.1 and 0.5 products as soon as possible and then move on.

*Jim Thompson* – but how do we come up with the pseudo-block estimate support?

How to bulk the data into 3 x 3 arc second grid? First convert the grid into the equal area projection; then calculate the bulk average.

*Zamir Libohova*: GlobCover land cover product for the world gives a mask file with 0 for dominantly soil and 1 for non-soil; the table gives a hierarchical numbering system used to assign unique IDs to each

nested grid cell. As for the mask we can use the land use land cover NLCD that is at 30 m resolution and resample it to the GSM specs.

May 09, 2012 - Afternoon Session

**13:13 – 14:00 - Report on gridded STATSGO2 property maps for soil carbon, texture, pH, soil depth, AWC, etc.**

*Zamir Libohova* – presented:

soil organic carbon maps for CONUS from STATSGO2.

His work converted pH from 1:5 water to 1:1 water with the formula ( $\text{pH}_{1:5w} = 0.51 + 1.05 * \text{pH}_{1:1w}$ )

maps of some texture, coarse fragments; awc, soil depth properties of CONUS

*Jim Thompson* – The maps are not independent of the geomorphic and geologic maps, so we shouldn't marvel that they match prior concepts of geomorphology and geology.

The general consensus was that the Soil depth map is unrealistic because it is populated from a data base that has depths of 160+ represented as 160 cm. Many deep soils were not entered as having a bottom depth.

*Norm Bliss* and *Zamir Libohova* suggested that a value of 150 cm should be chosen as the cutoff and *Jim Thompson* added that perhaps 149 cm so that everything is included. It was argued that 150 should yield the same results as 60 inches is 152.4 cm which is greater than the suggested 150 cm cutoff. Cautions were drawn by *Norm Bliss* about the fact that the reported depth of 150 cm may not always be consistent with the depths for the other reported properties and this should be taken into considerations.

**14:00 – 15:00 - AFCC Update on GSM activities**

*Scott Smith* and *Glenn Lelyk* – provided an update on the latest work conducted by AFCC on GSM soil property maps for version 0.1 and disaggregation pilot study at Manitoba and North Dakota border related to the versions 1+.

GSM soil property maps for v 0.1

The current work aims at developing raster product that follows GSM.net specifications from soil landscapes of Canada with an average of 3.22 components/soil map unit and to evaluate the version 0.1 products and data for future versions. Raster were created in ArcGIS from the SLC and available Provincial coverages, the data is not continuous, still controlled by soil components and grouped by polygons; used a raster table to a raster dataset. Used a geographically weighted mean and a spline depth function. They do not completely meet the GSM specifications; no uncertainty values; some of the methods are not documented completely yet; several northern regions are undergoing or planned to undergo upgrading.

Disaggregation work by Glenn and Bob Macmillan

Pilot study in southwestern Manitoba; they used LandMapR classification applied to 90 meter grid cells using SRTM DEM – this resulted in 15 default fuzzy landform classes; defined map zones – similar polygons with similar soils; identified which soil is most likely to occupy a landform in each map zone; created a database of soil property values at specified depths for all listed soils; calculated a weighted average for all soil property values at all depths and created a map; in each map zone identified you have 15 fuzzy landform classes (Fuz\_class); identified where the soils occur and how they could be paired up with the landform classes; 150 soils described; 40 unique soil associations; 8 associations had

more than 5 soils requiring 20 additional link tables; created a database of soil property values at specified depths for all listed soils;

What are the next steps? Review current GSM v0.1 and upgrade as possible; continue to monitor and guide development of the MOU; pilot area – Bob has produced a summary paper on the method, will provide comments to Bob and distribute.

#### **Action Items identified:**

Possible joint field trip this summer between US and Canadians soil scientist.

Upcoming events: Canadian Land Resource Network and Canadian Society of Soil Science DSM meetings, June 3-6 in Quebec City; It was discussed that the scientific coordinator of the GSM for North America node Dr. Jim Thompson participate in the meeting since the entire meeting is devoted to digital soil mapping.

SSSA DSM symposium in Cincinnati in October

#### **15:00 – 16:30 - Update on gridded SSURGO filled in with STATSGO2.**

Review of Dr. Norman Bliss' methods

*Norman Bliss* – provided a brief summary of the current work on SSURGO filled with STATSGO2 concurrent with v 0.5-0.9 of the GSM. He explained his methodology for SOC for conterminous US map that can be repeated for the other GSM properties. His approach starts with working from the horizon table to the component table (analysis) to the map unit and then applying that to the spatial data (mapping) Ch = ODRT Mukey, compct\_r, om\_r, dbthirdbar\_r, fraggt10\_r, etc

*Jim Thompson* – asked if does it make sense to come up with a standardized color ramp for given properties?

*Norm Bliss* - STATSGO2 did not get the high OM soils in northern MN and WI the way SSURGO does SSURGO filled with STATSGO2 can cause some problems with models because of discontinuities between the two data sets. Depth effect of carbon mapping causes difficulties in interpretation. That is, when you sum carbon for the whole profile, the SSURGO values are much higher because they have been sampled deeper. Same problem as with Zamir's reporting of the soil depth map. When you get to the deeper horizons you have a breakdown in reporting of soil properties; some observations are made in some cases, in other cases there are not any observations at these depths. Half of the carbon that is mapped is in 86% of the land; the upper half of the C is in the 16% of the land; the distribution is non-linear Thus a solution could be to sample based on where the carbon is, not on land area. SSURGO is much better data with better spatial resolution and better attribute quality. New SOC estimate for CONUS: 73.4 Pg. Moisture is more important than cold for C accumulation. Inform policy on strategies for C management Fossil fuel use is much more important than C sequestration in soil; let's not kid ourselves; soil carbon is a policy boondoggle (editorial comment)

To what extent does the merged SSURGO STATSGO2 product meet the specifications? They don't really meet the specs but they are helpful in getting a quick result and giving something we can build on.

*Sharon Waltman* - handed out a draft document called Soil Survey Investigations Report No. 53 Soil Survey Digital Mapping Methods Manual.

#### **Action items from first day:**

point support vs. block support decision needs to be made (which method is preferred by the group);

decide on a metadata standard;

Investigate of the possibility of having Norm go to work with the Mexican contingent directly;

We propose to meet Canadians at Manitoba/North Dakota border to look at the mapping that is being done there or at Cincinnati at SSSA meeting,

Color ramp and visualization standards;

August 26-30, 2013 is the GSM.net meeting about uncertainty is scheduled;

Errors and inconsistencies in the GSM specifications document need to be addressed and corrected, particularly with respect to data units and compatibilities. Everyone who has suggestions and comments regarding the inconsistencies in units and other GSM specks please submit them to *Jim Thompson*.

May 10, 2012 - Morning Session

**RECAP OF FIRST DAY** – *Sharon Waltman* presents

The purpose of the meeting is to review the status of North American US GSM.net efforts and to do some planning. Product definition – how much we intend to contribute; 0.1 version is derived from STATSGO2 product;

*Jon Hempel* – Zamir, can you outline what our product is going to be?

*Sharon Waltman* – we have 11 items and only a few hours to do it in; that is a lot to cover in a short time

*Zamir Libohova* – we discussed the specifications in detail yesterday; inconsistencies were noticed in the GSM specifications; today we want to assign tasks to people to do things; we are not going to be able to provide the point or block support because we don't have that amount of data; we are going to do a simple gridding project; we should do a gridded STATSGO2; we sample STATSGO2 at the center of the grid cell; each property at each depth is provided as a separate raster;

*Jim Thompson* – this discussion is beyond the scope of this meeting; this is a data infrastructure issue, which we can address later; whether we use a lookup table or separate rasters.

*Sharon Waltman* – we agree that there are 12 items and 6 layers, so that we need to provide either a master raster with 72 attributes x 3 predictions intervals (low, rev and high), splines will be provided so we don't need to offer this; to build the spline we just need the horizon values and the lambda plus the correction values to correct negative values;

*Tom D'Avello* – a lot of detail needs to be figured out;

Data model team will decide whether the product is raster vs. points, raster with attribute tables, separate rasters, or other formats.

**ITEMS**

Translating US, NA data products to 3-arcsecond grid projection:

- Zamir Libohova and Travis Nauman will find and/or generate the 3-arcsecond grid that is compatible with all grids used by the other nodes;
- then we bring the grid into our projection space.

Point estimates vs. block estimates:

- one choice: in 0.1 we will have a point estimate at the center of the grid cell regardless of whether that point falls within the soil map units that occupies the majority of the cell or not.
- the other choice: polygon weighted means;
- The simple straight forward approach is the center of the grid cell. The other approach is computationally possible but cumbersome and may not make a big difference in the end. Besides cases where a grid cell contains more than 1 soil map unit may only comprise a very small portion of the map (less than 5%). This approach would create other issues for validation as we are now dealing with the weighted mean of the weighted mean since the smu values are weighted means based on soil map unit components in the first place.
- Both choices with STATGSO2 at the scale of 100 m x 100 m it won't make a difference which one we use

## Decision

- **We will use a single point intercept query at the center of the coordinate of the coordinate system for version 0.1;**
- **The polygon that intersects the center point of the grid cell will be the reported as the value at that grid cell in version 0.1.**

Spline vs. weighted means, do we use our traditional method of using weighted averages, or do we use the spline function

- A) Use a spline to interpolate values at all depths in the solum;
- B) Use a weighted means approach instead of the spline function to estimate soil properties at various depths
- *Zamir Libohova* wants to do a case study of pedons. The work is still in progress.
- *Sharon Waltman* suggests that we don't gain by using the spline;
- The spline deals well with missing data; depth weighted means methods may not.

## Decision

- **Use equal area tension spline as an interpolation technique for horizon estimates, even though there are errors, particularly at the tops and bottoms of profiles, if these errors can be corrected then we should use the spline; proceed with the spline in version 0.1; the spline has problems and these need to be addressed in the future**

## National Atlas for Sustainability (NAS)

*Annie Neale*, Project Lead present

The atlas is an online decision support tool allowing users to view, analyze, and interpret the geographical distribution of supply, demand, and drivers of change in ecosystem services; the target audience is influencers, analyzers, decision-makers;

Recommendations from the recent president's council of advisors on science and technology (PCAST); White House is taking these recommendations seriously; recommendations are in line with the atlas; there has been interest from the PCAST in the atlas; who is doing this? EPA folks, student services contractors (with 3 year appointments); many partner organizations (incl. NRCS, USGS, others); GEO platform is being developed that mimics ArcGIS.com; it is a portal that houses geodata; the Atlas project has become overwhelmingly large; they have 9 tasks – create foundational data necessary for calculation of metrics for National Atlas for Sustainability, web-based atlas, ecosystem services methods and metrics for national scale, ecosystem services for town scale, develop tools in the NAS, sustainability metrics, integration with other projects, contextual information, outreach; how do we effectively quantify ecosystem services? What is the supply in relation to demand (current and future); how do drivers affect the services; how prioritize projects; vision for project – continue clickable background maps, allow stacking of multiple services, include change and future scenarios, allow user to place their “area” in context to others, ability to navigate up and down stream, link to other web services and tools, more than maps, no software needed; multiple ecosystem services to be stacked, such as: clean water, climate stabilization, clean air, habitat/biodiversity, food fiber, fuels, protection from weather hazards, water quantity/timing, cultural aesthetic recreational amenities; soils factor into every one of these benefits; includes interpretive information (more than maps); explore relationships between ecosystem health and human health; for every data layer in the atlas we have the FGDC compliant metadata, we are also creating a fact sheet that goes with each data layer; developing NAS for conterminous US only initially; climate stabilization (not climate regulation); example of NAS project – sources and sinks of nitrogen, transformations, mitigations, soil information used in this work, using flow accumulation

metrics in empirical models, average flow path buffer width from agriculture cells, % ag. draining to stream without passing through naturally vegetated buffer, combination of poorly drained soils as a surrogate for artificial drainage, estimating relative buffer effectiveness at removing nitrogen – Jay Christensen, IALE 2011; Example of metrics: Hydric Soil + Restorable Land Use + Topographical Wetness Index > 5.5 = potentially restorable wetlands?, data sources – hydric soil, ssourgo+statsgo2, restorable land use – nlcd + cropland data layer, topographical wetness index (30m), John Richards (Region 4) --- **an area for future research**, know whether TWI 5.5 is a cutoff value that can be applied across the US or not; NAS currently contains about 50 different metrics for the nation and at least 10 different reference maps, full public release expected in 2013; future vision, multiple map viewer, clip and ship, incorporate user's own data, change symbology, HUC navigation and raindrop tool, additional data analysis tools, future scenario analysis tools, watershed summary reports, integrated modeling within Atlas and by links to other tools;

*Jon Hempel* – how would you refresh your data as we update our data?

*Annie Neale* – reference data layers would be easy, but for some of the calculated data layers we would refresh,

*Zamir Libohova* – How would you avoid parallel data sets and infrastructure?

*Annie Neale* – The NGDC has established rules and guidelines for addressing this issue.

*Zamir Libohova* – One of our concerns has been that willingness of EPA to accept the GSM standard depths for soil properties. Would you accept these depths for your maps displayed in the ATLAS projects and would it be better to provide direct links to the data rather than displaying them in ATLAS as this may create update issues as to which is the most current product?

*Annie Neale* – We will accept the standards that are followed by your agency and we will provide the data or an interpretative map along with a link to the source. However, she will consult with the parties involved before providing a definite answer

**NOTE:** A follow up e-mail was sent by *Annie Neale* regarding some ATLAS products and interested parties. The following is the message: from Anne C. Neale: send on May 11, 2012.

Start of Message:

“I just wanted to follow up about the two projects I mentioned. First the Commission for Environmental Cooperation ([www.cec.org](http://www.cec.org)) which is producing the North American Environmental Atlas. I would think there might be interest from that group (if they are still active) on the North American soils mapping work you are all doing and some of their downloadable data may be of some use.

About Roger Sayre's ecosystem mapping work. He has completed South America and the US but not Mexico or Canada (<http://rmsgsc.cr.usgs.gov/ecosystems/dataviewer.shtml>). He may have gathered some of the data for the NA continent as their goal is to map ecosystems globally or he may know of some good data sources so it still may be worth contacting him.

Best,

Annie

Anne C. Neale

Landscape Ecology Branch

USEPA, E243-05, NERL, ESD

Research Triangle Park, NC 27711

Phone: (919) 541-3832

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End of Message

May 10, 2012 - Afternoon Session

### **Mexico Update – INEGI work** Teleconference with *Eliseo Guerrero (Thomas Reinsch interpreting)*

*Norm Bliss* - provides an update on Mexico work for generating the GSM soil properties. Spatial data contains 75,491 polygons, and 23,962 map units at scale 1:250,000. CLAVE\_WRB the most important column in the attribute data. Pedon data sorted on profile id with horizons numbers and depths and properties. Still some issues with it. To be discussed with Eliseo. Matching of pedons with components is dependent on the rules. Stricter rules would yield less matches, less strict rules would result in more matches. Need to develop some rules.

Some of issues encountered so far:

Corrects typos in codes from names, polygon labels (some in doubt omit or guess), Include physiographic region attribute and use it to see how closely they match and set distance criteria, Map projection before selecting grid points, spline, review and delivery.

Questions:

*Mexico*: How did you make the relationship on the matching?

*Norm Bliss*: Not yet done I am still working on it, when done I will present

*Mexico*: What was the source of physiographic regions?

*Norm Bliss*: from Eliseo.

*Mexico*: these are provinces not physiographic regions.

*Norm Bliss*: I would look for it, if not have it ask for it.

*Mexico*: yes please ask if you need it.

*Travis Nauman*: Has the point based approach been considered besides gridding polygons? Like use polygons as a covariate. Or other terrain attributes. SRTM can be used as well.

*Jon Hempel*: gridded was the fastest way to meet the GSM specs, but yes we should do this for the future.

*Zamir Libohova* - there may not be enough data points for this even in the best scenario like the Indiana case study where the number of pedons is 1/25km<sup>2</sup>. Often the accuracy of the points locations is variable on average by 200m especially for the ones that were derived from Public Land Survey descriptions. But we will work on this in the future.

*Jon Hempel*: Is Mexico interested in hosting the GSM for North America node

*Norm Bliss*: Also for me coming for showing the work done so far.

*Mexico* – Yes on both accounts.

*Anne Neale* - mapping global ecosystems is a USGS initiative so there may be lots of covariates that can be used (related to Travis Nauman suggestions).

### **Memorandum of Understanding (MOU) between NRCS and University Cooperators for the GSM Project.**

*Zamir Libohova* - explained the content and the purpose of the MOU between NRCS and Universities for GSM. The major driver is to attract more funding and students to do the work. The MOU is in its draft stage and once the responsible parties for signing the document from each university and NRCS are identified the MOU will be send to the NRCS legal experts for the final touches. The merits of having separate MOU between NRCS and each university as supposed to only one between NRCS and all universities were discussed. A separate one for each university it is easier to acquire but it perhaps does not have the same appeal as the one with all the universities in one MOU. This latest option has its downside as it has to go through the review and approval process each time a new university joins in.

*Phillip Owens*: Funding is an issue. He suggested as an **Action Item** for the NCSS that when request for proposals are send out it should be specified that some be dedicated to GSM.net effort.

*Travis Nauman*: Other universities can apply and there are other sources outside of NCSS for \$.

*Sharon Waltman:* look broader for funding sources like NASA, EPA etc

*Phillip Owens:* Other universities can get together and submit proposals as joint.

*Anne Neale:* North America Atlas is a source for funding.

*Sharon Waltman:* is there any gsm related group at SSSJ?

*Jim Thompson:* yes there is one that meets every year. There is a global soil mapping community

*Zamir Libohova:* perhaps the universities need to get together and write proposal with NRCS blessing

*Jim Thomson:* Yes, but there is a need for white paper from NRCS to say that this is important, so that the proposal is filling a gap identified by the white paper. Example, for ecosystem services etc.

*Travis Nauman:* so if you give the ammunition by the way of the white paper then other universities get in the game.

*Phillip Owens:* there is a lack of info as to where to focus. Some cooperators don't know a lot all they hear is GSM but that is it.

*Zamir Libohova* proposed an **Action Item** to design a white paper and present it to the NCCS meetings: The following are suggestions made by the participants:

*Sharon Waltman:* design one with goals and a plan, and be specific on the research aspect

*Norm Bliss,* incorporate the importance to ecosystem societies

*Anne Neale,* a table of what we have and where we would like to be (so what and who cares)

*Zamir Libohova* and *Travis Nauman* to work together to prepare a 2 page only white paper.

*Phillip Owens:* Can NCCS have a technical writer to help us write proposals?

*Phillip Owens* send an e-mail later with some links for sites that accept requests for proposals.

[http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=13690](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13690)

[http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=5410&org=NSF](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5410&org=NSF)

### **Remaining properties and task assignment**

*Dave Hoover:* why do we need the mukey

*Jim Thompson:* for internal qa/qc and update. When delivered there will be no mukey column just a grid.

*Jim Thompson:* coarse fragments formula of Nathan.

Fragg10 and 3-10 are they volume based or ratio. Lab gives volume and mass ratio. There are two tables one horizon reports weight % and volume. The weight by % was used. Nathan gives mass ratio gr. kg calculated from weight % by volume.

*Norm Bliss:* the formula by Nathan need to be looked at. Verify the calculation Nathan has done with the one done previously by Norm, this to be an **Action Item**. *Norm Bliss, Travis Nauman, and Sharon Waltman* to follow on this.

*Zamir Libohova:* what about the low and high for coarse fragments?

*Norm Bliss:* only 10% is populated so needs to be further studied.

*Bill Waltman:* two fractions are missing in sdm and laboratory data profiles etc.

*Travis Nauman:* There are discrepancies between ssurgo and soil survey manuals.

*Bob and Jim:* The lab only gives >2 mm i.e. from 2-75mm. however, the soil descriptions have other fractions described. This is a mismatch. Sometimes the frac > 10 inch not described. So, again there are inconsistencies.

*Sharon Waltman:* should we write a white paper? Review the calculations.

*Bill Waltman:* perhaps leave as is for now.

*Zamir Libohova:* when we get \$ get a grad student to study this.

*Travis Nauman:* what source do we use to pull the data? Soil survey manuals, sdm or pedons. Is this consistent through the country?

*Bill Waltman:* the manuscript has volumetric from field estimates. Some manuscripts have used lab data that is in other units like weight basis then converted to perhaps to volumetric.

*Sharon Waltman:* S5 used a lot b/c more complete.

*Bill Waltman:* if done for weight basis then the resulting coarse fragments will be 1/3 more in volume compared to percent basis. So if on national level this needs to be taken into account.

**Action Item:**

*Norm Bliss:* for our gsm. let use chorizon table for now.

*Bill Waltman:* this might inflate the SOC map also.

*Sharon Waltman:* **Action Item:** check the units' conversion *Nathan* did. The sdm is more complete b/c in the lab the samples do not have all the frags.

Soil Depth: Needs to be re-done

*Jim Thompson:* how to fix:

*Dave Hoover:* cut it to 150 cm (60 inches) b/c this was consistent.

*Zamir Libohova:* make sure to state from the start that is deliberately cut to 150 cm.

Soil depth: if the chtexture table has depth to lithic paralithic is gsm soil depth definition.

The group consensus was if the restrictive layer is not specified then assign 9999

If it is explicitly mentioned then assign the value where it stops.

*Travis Nauman:* we could use the surficial geology.

Effective soil depth if the chtexture table. The chorizon table has only h1, h2 and h3 layers named not with say horizon designations describing limiting later like Bk etc. also look at the tax description, if lithic specified then assign a range.

*Bill Waltman:* osd might be the way to go perhaps to verify the depths.

Bulk density: so far we have it for frac <2 mm. we need to scale it to include the rock frag values produced from weight to volume.

AWC – needs to be done for all layers. STATSGO2 has it corrected for rock frag, salt content. So results are in mm. use the same approach as for other properties

ECEC: CEC7 is populated but ECEC only has 4 records for this in STATSGO. Need to be investigated.

**Action Item:** Zamir Libohova to see if we can use the pedotransfer functions.

Currency: Statsgo2, 2006. Started in 1984 and it froze in 1992 then did the calculations.

Metadata: someone has to write the metadata. Metadata who is to write them.

**Action Item:** Sharon and Aaron to identify the current NGDC standards.

**Scrutiny and peer review.** Who is going to do it? What is the process?

Different levels of this: internal

within the NSSC since they know the data, Dave Hoover could help this process at the center.

within the gsm group cooperators,

then for the dsm

generate a low resolution re-sampled from the 90 m and quickly let it display for comments.

Run few check calculations, perhaps during the process.

**Uncertainty:** several options are discussed for version 0.1 only at this stage:

Use the low and highs as PI 95%

Use the weighted mean of l and h just like r

Use low of lowest or high of highest.

The group consensus was to use the third option (the low of the lowest and the highest of the high).

**Task Assignment:**

Norm Bliss: to finish the work on Mexico and visit with them.

<b>Nr.</b>	<b>Tasks</b>	<b>Person(s)</b>	<b>Target Data</b>
1	Finish Mexico SRTM point grid inters. STATSGO2	Norm Bliss	July, 2012
2	grid	Zamir, Travis, Norm (review)	June
3	Remaining properties Soil Depth (eff, and restr) Bulk density (h and l) AWC (r, h and l) Coarse Fragments (l,r,h)	Zamir, Travis, Aaron, Tom	End of August
4	Review of existing and new maps	NSSC-Dave Hoover	End of September
5	Metadata Standards	Aaron	
6	Metadata Methods	Zamir, Travis, Aaron, Tom	End of August
7	Deliverables	GSM science comitte	End of October