

GLOBAL SYMPOSIUM ON SALT-AFFECTED SOILS

20 - 22
October, 2021
Virtual meeting



National contribution: Mexico

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Centro de Geociencias, Universidad Nacional Autonoma de Mexico



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Focal point: Dra. Sol Ortiz

Dirección General de Política, Prospección y Cambio Climático

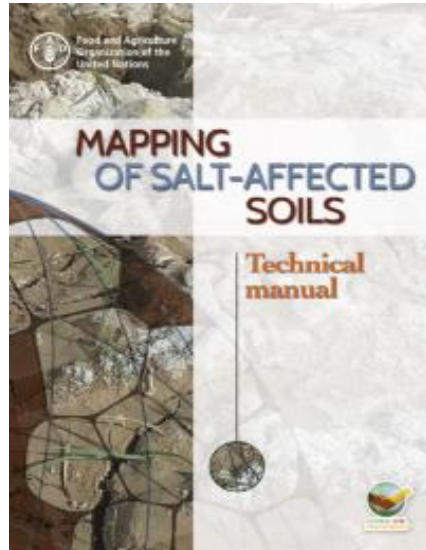
Secretaría de Agricultura y Desarrollo Rural de México

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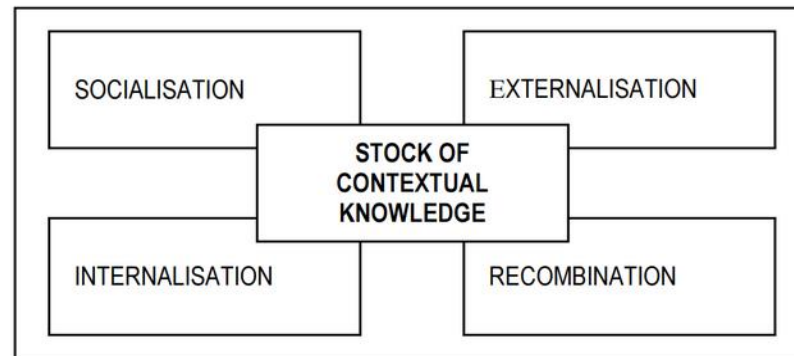
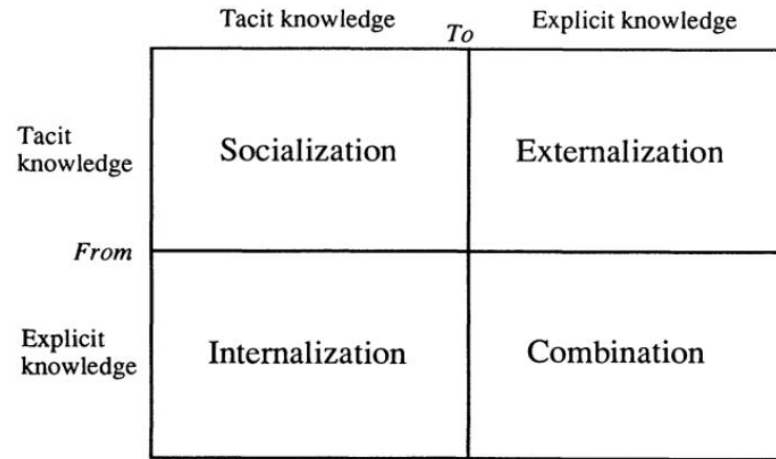
Increase the quality, quantity and access of soil salinity information across Mexico

- Build technical and institutional capacities for soil salinity mapping and monitoring
- Update soil salinity estimates to support sustainable soil management

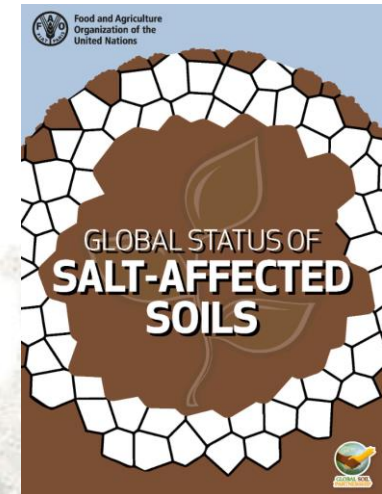
Organizational knowledge creation systems



Digital soil mapping



Increase diversity of soil information users



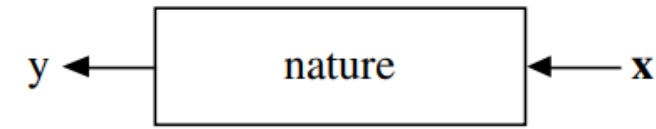
Digital soil evaluation



Nonaka, 1994

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Digital soil mapping



$$SA(z, p_x, t_c) = f \left\{ \sum_j^n (S_j(z, p_x, t_c), T_j(p_x, t_c), E_j(p_x, t_c), P_j(p_x, t_c)) \right\},$$

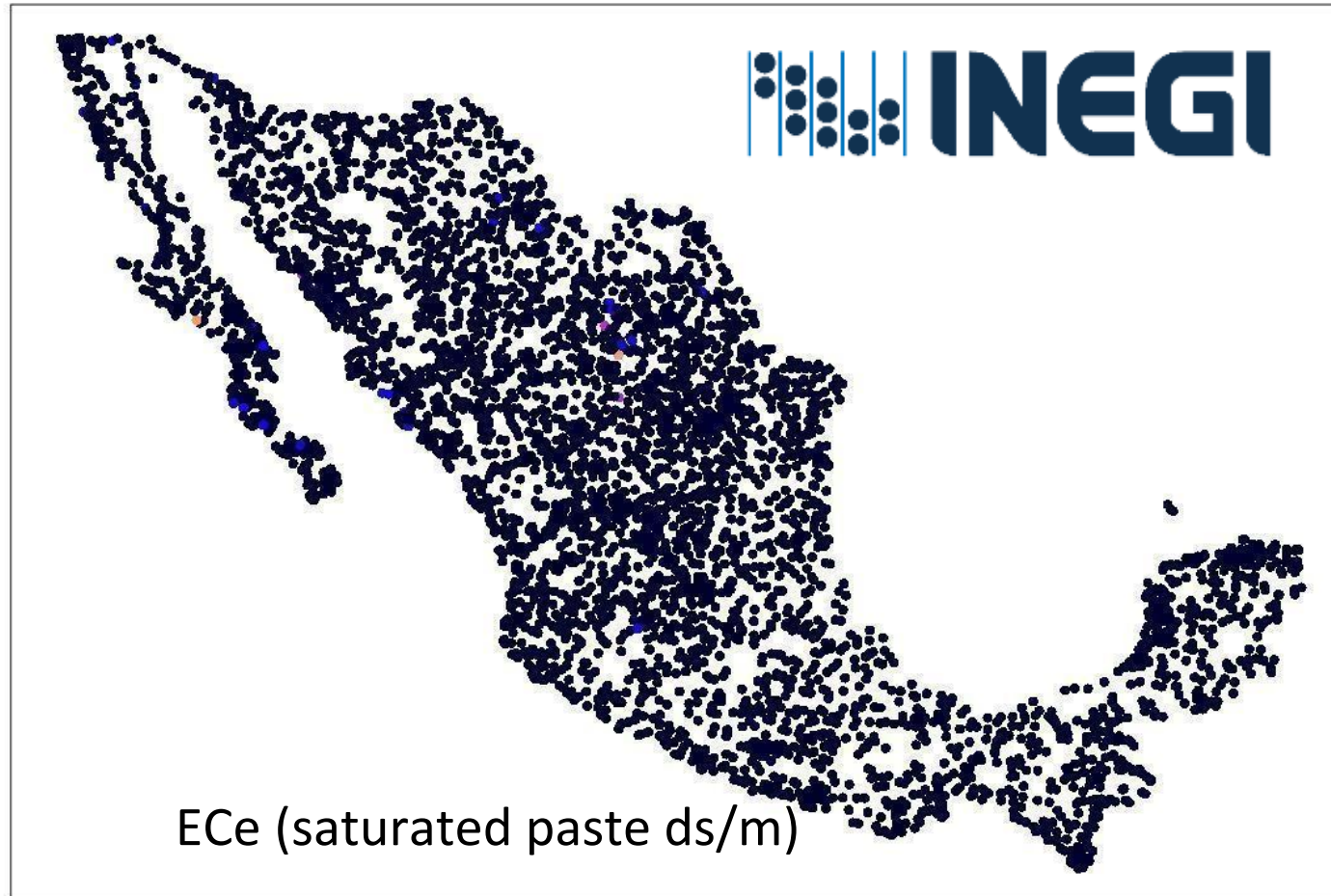
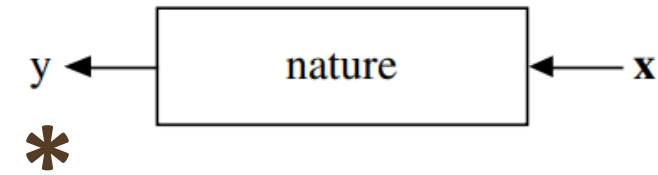
$$\int_{i=0}^m \left\{ \sum_j^n (A_j(p_x, t_i), W_j(p_x, t_i), B_j(p_x, t_i), H_j(p_x, t_i)) \right\}, \quad (4)$$

SA = ECe, pH, ESP
 z = 0-30 and 60-100 cm of soil depth
 p_x = lat, long
 t_c = period of time
 t_i = specific period of time

Static predictor:
 S=soils, E=ecosystem type, P=parent material,
 Dynamic predictors:
 A=atmosphere, W=water, B=biology, H=human

Moore et al., 1993; Scull et al., 2003, Hengl 2003;
 McBratney et al., 2003; Grunwald et al., 2011

Training dataset



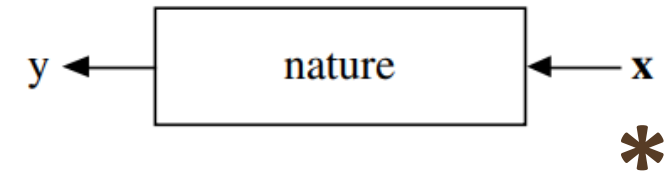
ECe (saturated paste ds/m)

- [0,20]
- (20,40]
- (40,60]
- (60,80]
- (80,100]

INEGI, Serie 2; 2852 data / sites collected > 1999

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The covariate space



The screenshot shows the Google Earth Engine interface. At the top, there's a search bar and navigation icons. Below that, there are tabs for "Scripts", "Docs", and "Assets". The "Scripts" tab is active, showing a script editor with the following code:

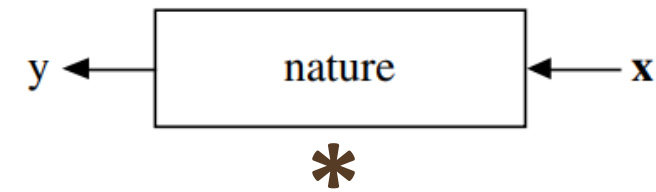
```
220 .clip(bounds)
227 ;
228 var npp = dataset.select('Npp_mean');
229 var nppVis = {
230   min: 0.0,
231   max: 19000.0,
232   palette: ['bbe029', '0a9501', '074b03']
233 }
```

The "Inspector" tab shows the message: "Use print(...) to write to this console." Below the script editor is a map view showing a satellite image of a landscape with green and brown areas.



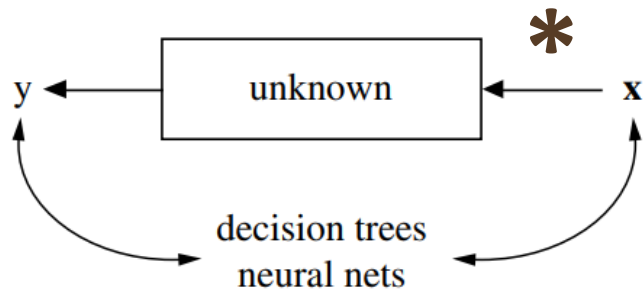
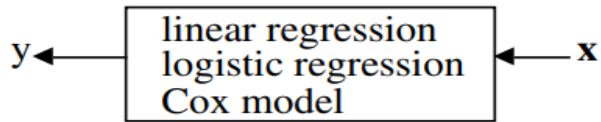
- Remote sensing
- Terrain attributes
- Climate surfaces
- Thematic maps

Modeling framework

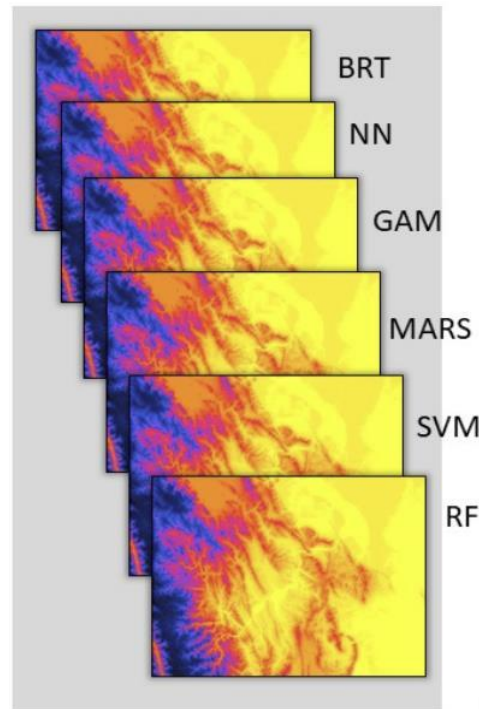


NEW

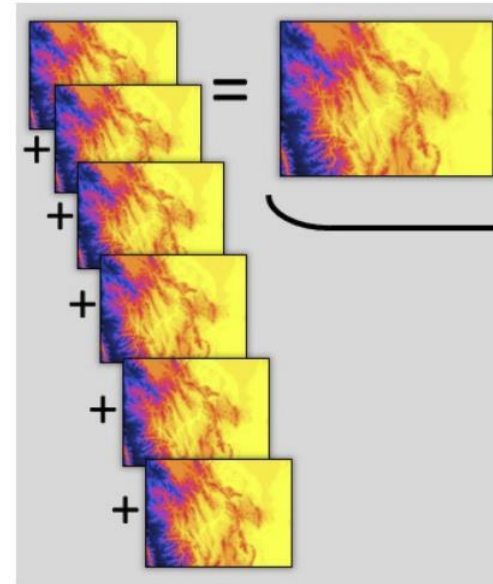
MACHISPLIN



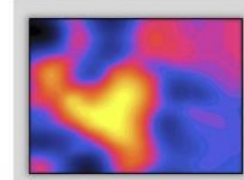
STEP 1
Model using 6 algorithms



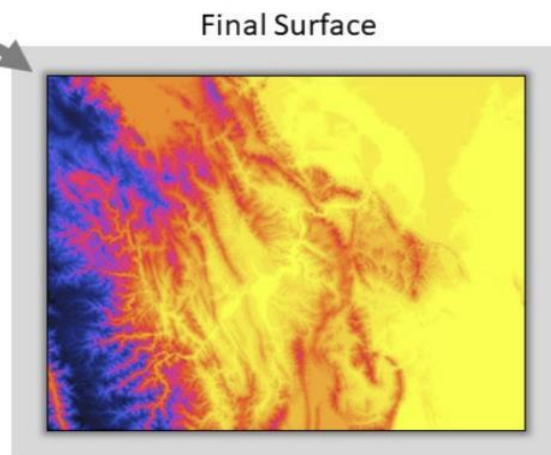
STEP 2
Weighted ensemble of models



STEP 3
Thin-plate-spline of residuals

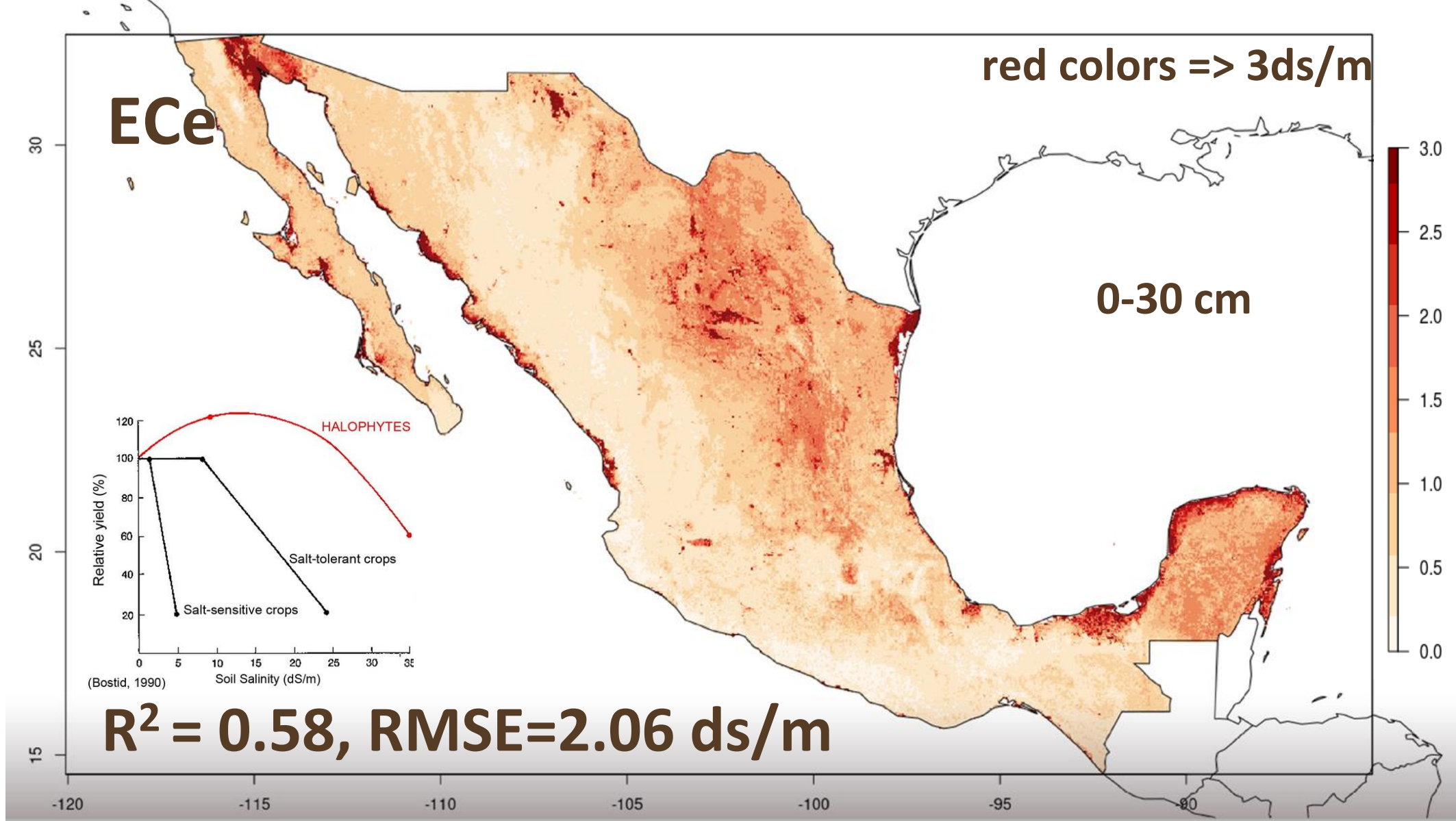


STEP 4
Sum outputs from steps 2 & 3



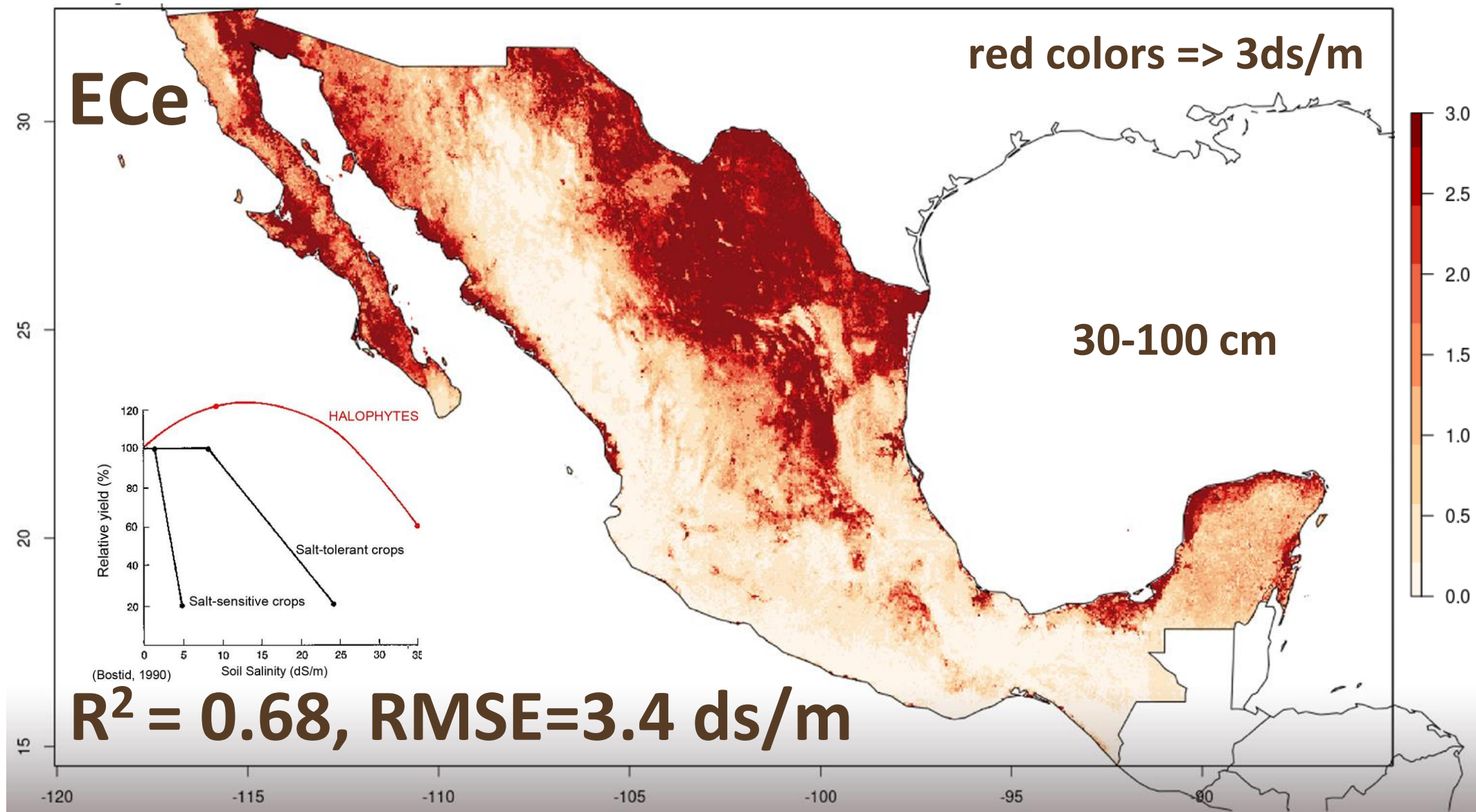
<https://github.com/jasonleebrown/machisplin>

Overview of process

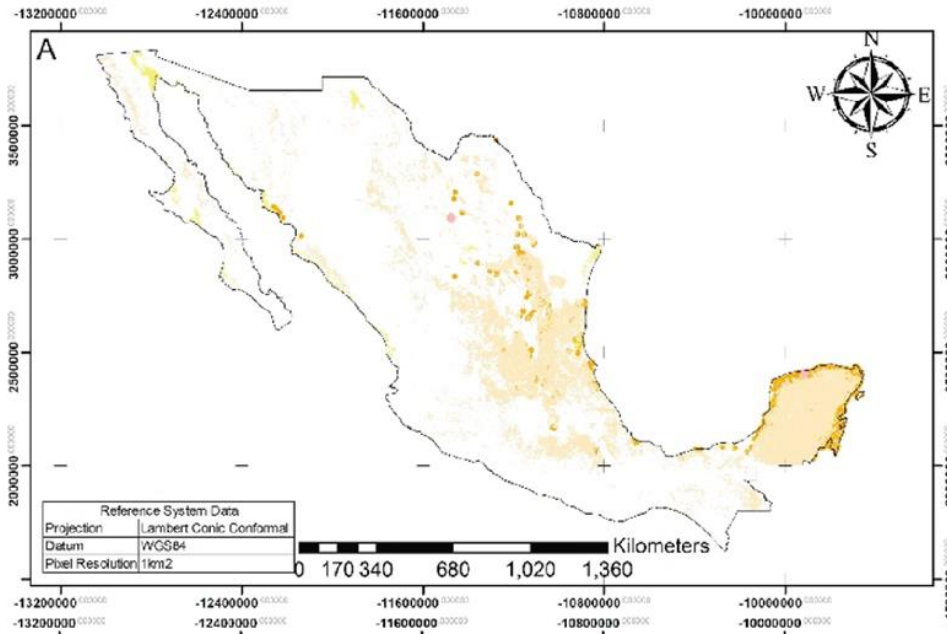


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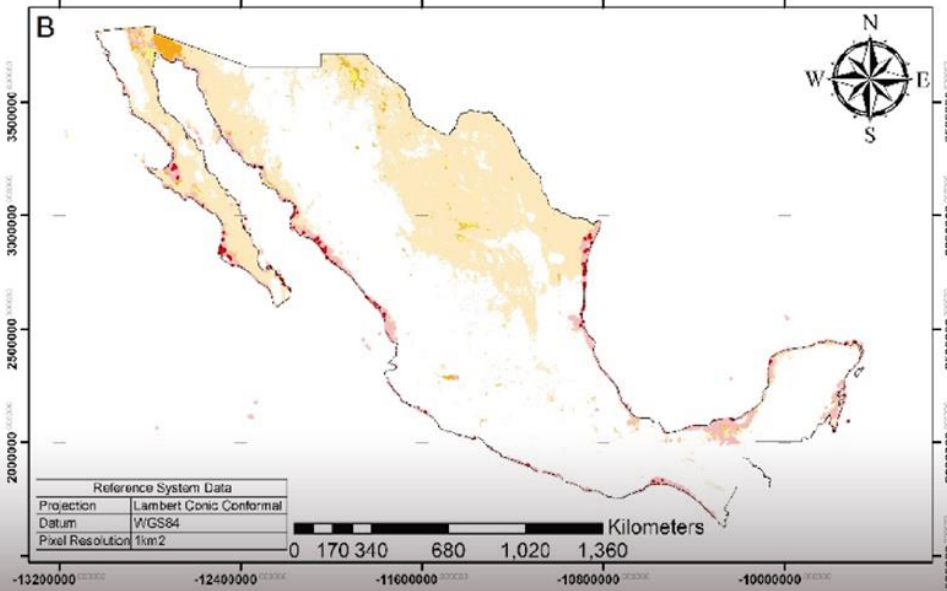
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34% of the territory

Salinity affectation 0-30 cm

- None
- Saline Sodic
- Slight Salinity
- Moderate Salinity
- Strong Salinity
- Very Strong Salinity



60% of the territory

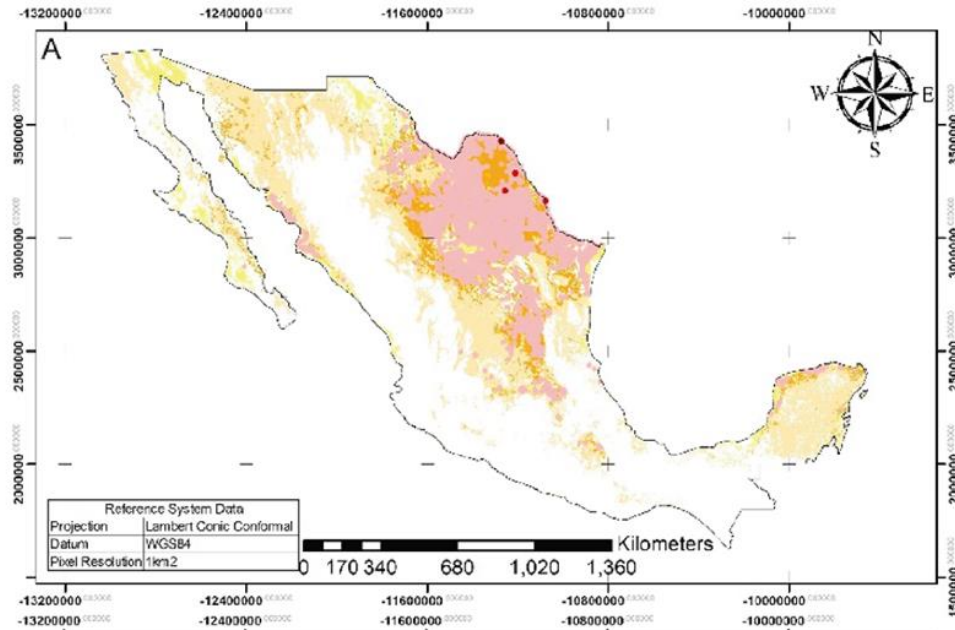
Sodicy affectation 0-30 cm

- None
- Slight Sodicy
- Moderate Sodicy
- Saline Sodic
- Strong Sodicy
- Very Strong Sodicy



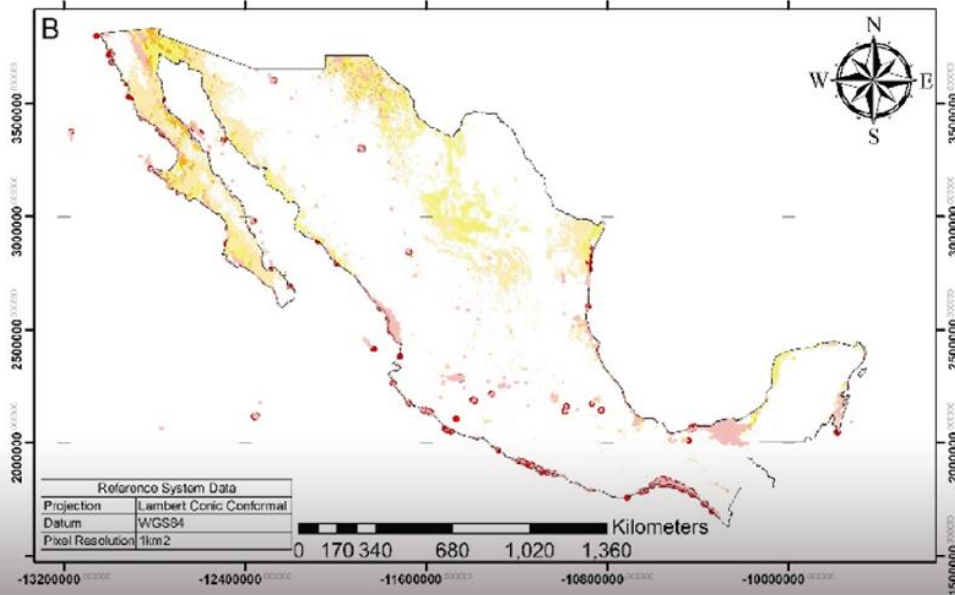
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October, 2021



40% of the territory

Salinity affectation 30-100 cm



35% of the territory

Sodicty affectation 30-100 cm



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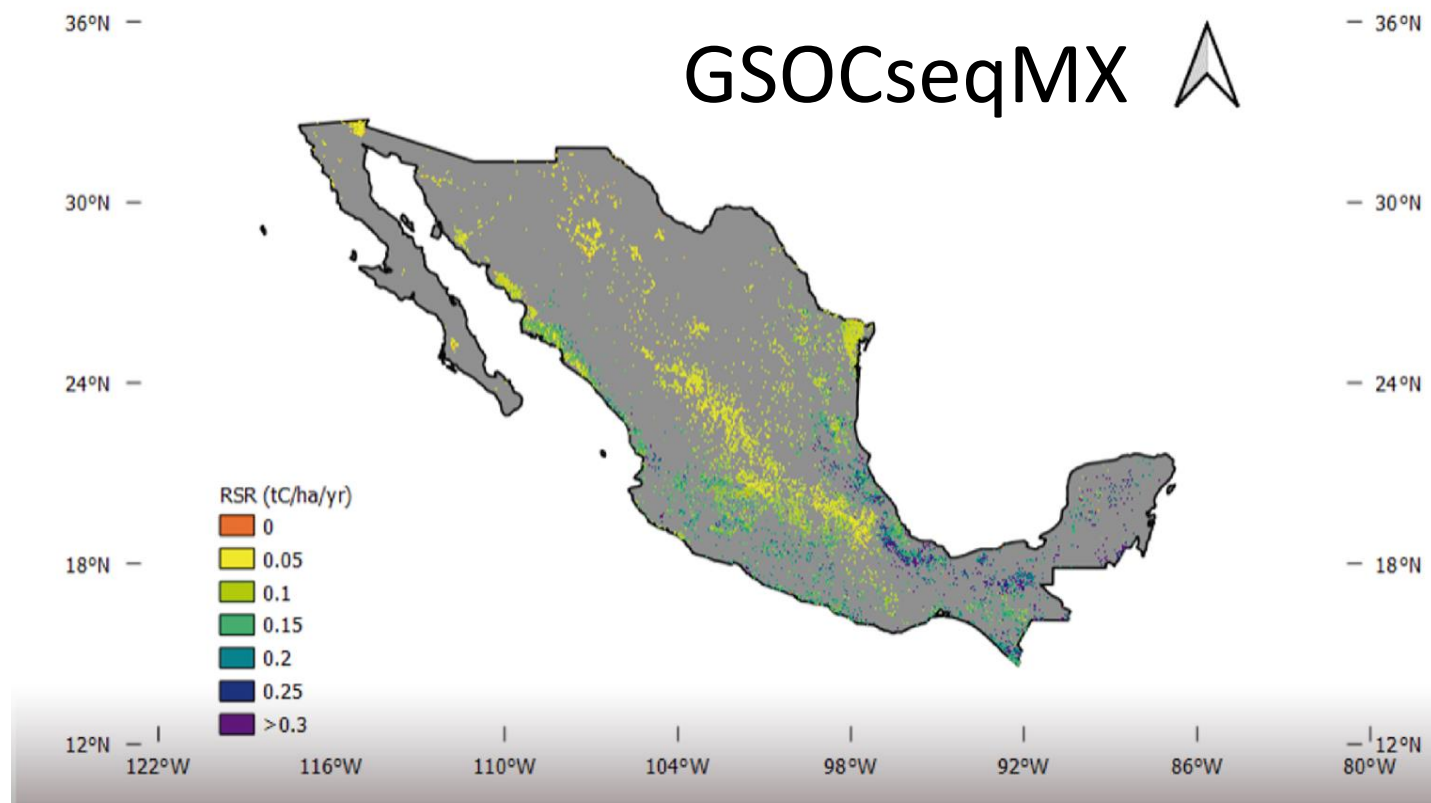
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Salt affected soil across agricultural land

- 0-30 cm
 - 46.94% rainfed
 - 53.06% irrigation agriculture
- 30-100 cm
 - 44.15% rainfed
 - 55.85% irrigated agriculture

Implications on SOC stocks



Our results highlight the pressing need to reverse land degradation by soil salinization

- Areas of salt affected are present across all ecosystems, larger affected areas are below 30 cm of soil depth
- ~ 50% of agricultural soils are affected by some degree of soil salinity including both irrigation agricultural systems and rainfed agriculture



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