GlobalSoilMap.net and the new Global Soil Information System

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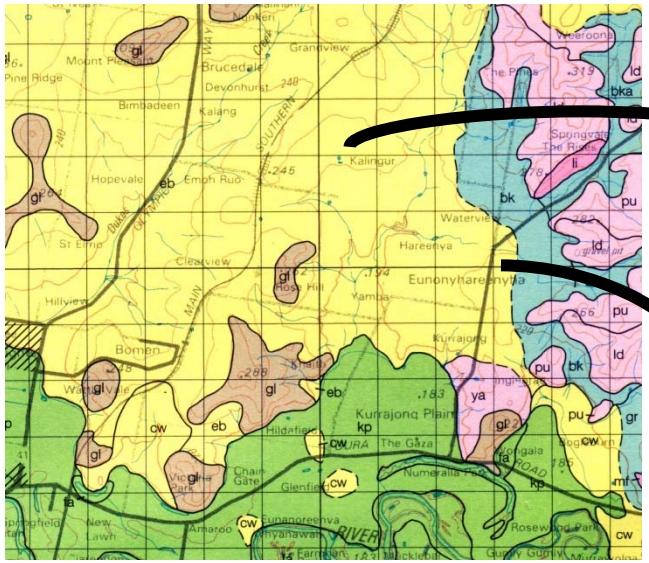
Outline

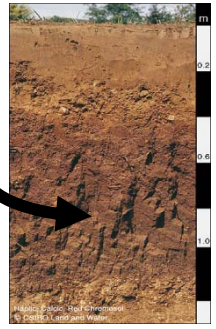
- The demand for soil information
- Development of *GlobalSoilMap.net*
- Specifications and products
- Frequently asked questions
- How do countries contribute to *GlobalSoilMap.net*
- The significance of this meeting

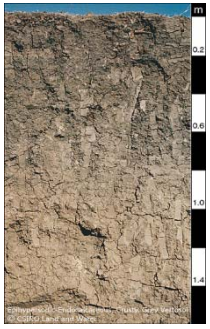
State of global soil information

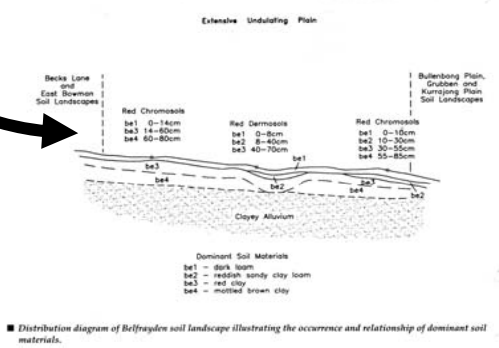
- Out of date
- Very generalised scale
- Limited capacity to incorporate new information

- Soil classes
- Complex data model
- Current global data sets represent a small proportion of existing information









■ *Distribution diagram of Belfrayden soil landscape illustrating the occurrence and relationship of dominant soil materials.*

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Soil survey and monitoring

- Declining investment worldwide from the 1970s to late 1990s (similar to agricultural science)
- Run down of institutions and capability
- Situation is changing now
  - Large sampling programs for baseline estimation of soil carbon and soil monitoring
  - Integration studies (e.g. European Commission)
  - New surveys to guide intensification of agriculture in developing countries (e.g. Ethiopia)
  - Global Soil Partnership
- We have to ensure new investments yield a good return on investment

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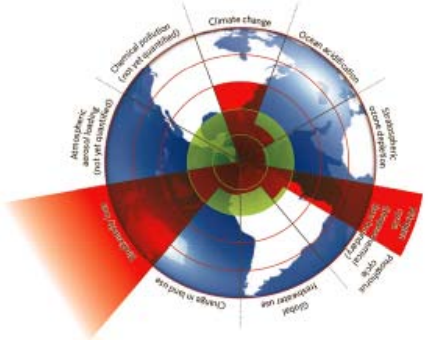
The need for soil information

- The demand for soil information is increasing and it is essential for :
  - Ensuring sustainable production of food, fibre and fuel
  - Assessing rates of land degradation
  - Adapting to climate change
  - Managing land and water resources (particularly terrestrial carbon)
- We urgently need:
  - Information on the functional properties of soils (not soil classes)
  - In a format compatible with other environmental data (terrain, remote sensing) and simulation models
  - Along with an estimate of the uncertainty



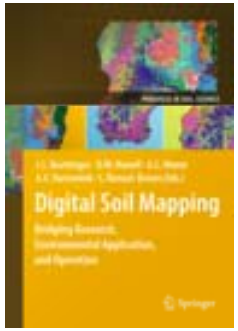
Pedology + Pedometrics = Digital Soil Mapping
Key meetings and events

1. **Montpellier, France 2004**
   - Synthesis of pedometrics and pedology
   - The Digital Soil Mapping community emerges

2. **Rio de Janeiro, Brazil 2006**
   - Digital Soil Mapping in regions with sparse data
   - A key idea – a global grid starting with available water capacity

3. **World Congress of Soils 2006**
   - Jeffrey Sachs Challenge

4. **Bill and Melinda Gates Foundation 2008**
   - AfSIS and formulation of the Consortium
   - Logan, Utah, USA, DSM
   - Agreed framework for *GlobalSoilMap.net*



5. **Rome 2010 and Ispra 2011**
   - Developing the technical specifications and proof of concept

6. **Nanjing 2012**
   - Launch of the Technical Specifications

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The goal

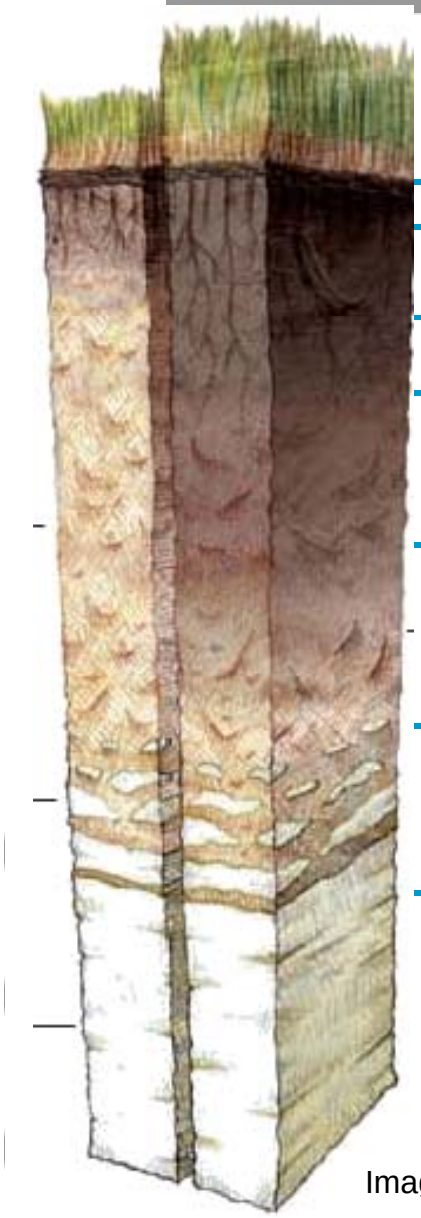

Image: Alfred Hartemink

- Fine-resolution grid (~100m) of the world
- Estimation of functional soil properties
  - Organic carbon (g/kg)
  - Percentage sand, silt, clay and coarse fragments
  - pH
  - Depth to bedrock or restricting layer (m)
  - Bulk density (kg/m3)
  - Available water capacity (mm/m)
  - Effective cation exchange capacity (incl. exch. acidity mol/kg)
  - Electrical conductivity (dS/m)
- Provision of uncertainties for all estimates

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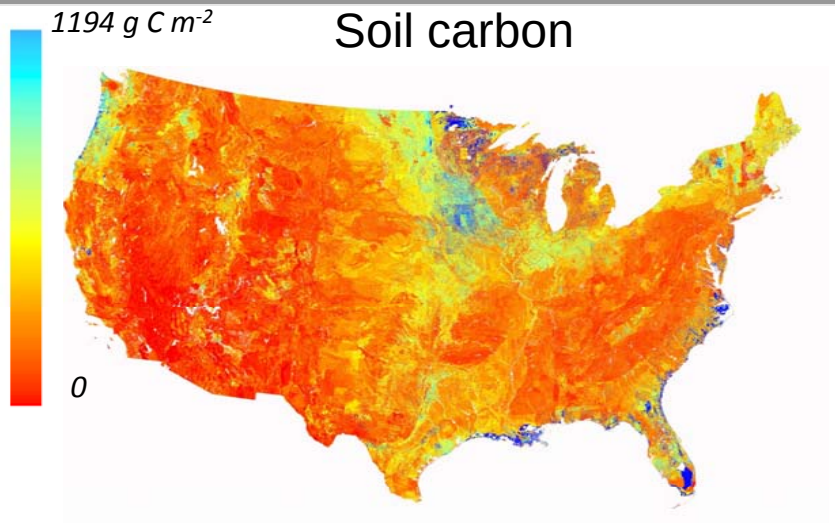
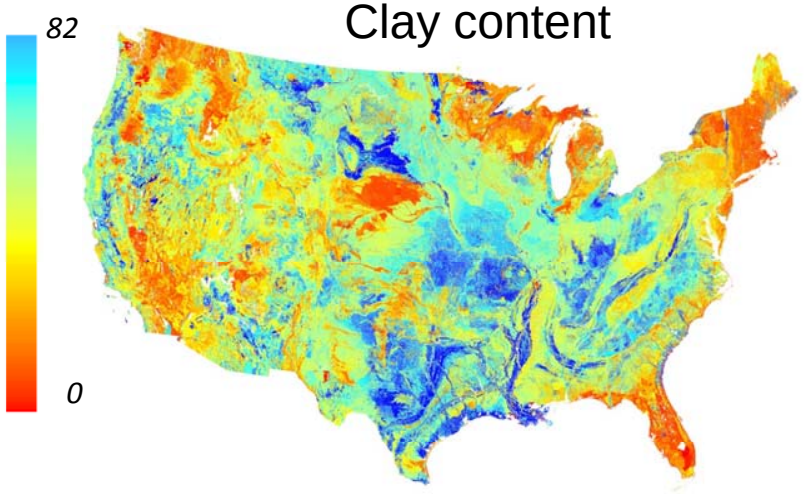
The products

- Fine-resolution gridded data supplied via the Internet
- Grid estimates are integrated over a depth and volume defined by the user
- Estimates for a grid cell include a point and block estimate of each soil property and its uncertainty
- Many derived variables will be possible





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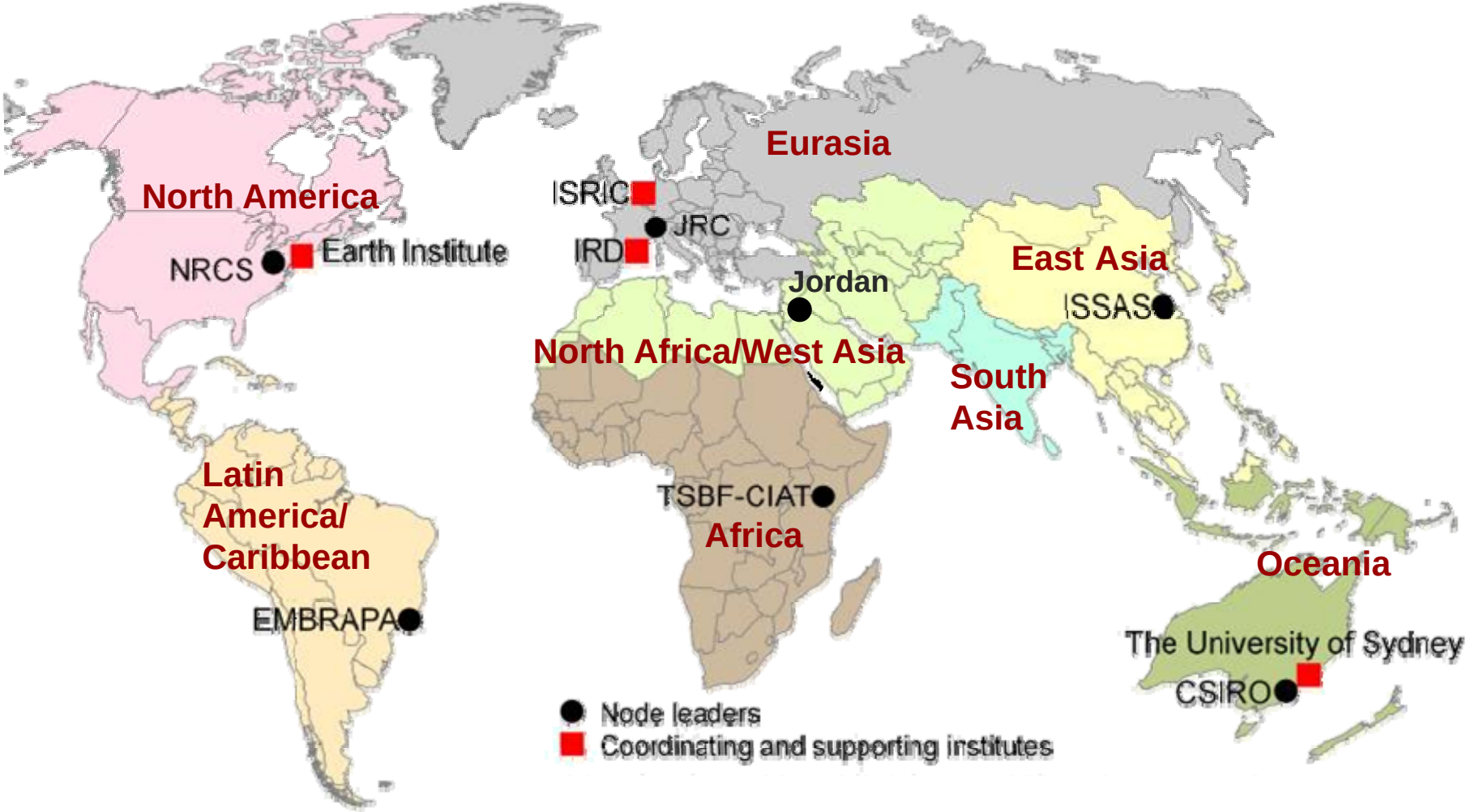
The Global Effort



JRC EUROPEAN COMMISSION · AfricaSoils.net · United States Department of Agriculture NRCS Natural Resources Conservation Service · ISRIC World Soil Information · CSIRO · The Earth Institute AT COLUMBIA UNIVERSITY · CIAT International Center for Tropical Agriculture · Embrapa · The University of Sydney · ISSCAS

Organisation

"It is sensible ….. but ain't no small project" Norman Borlaug, August 2006

- Governance and structure defined by the memorandum of understanding
- Nodes are now active and several have similar memoranda
- Working groups are addressing
  - Specifications
  - Data model
  - Prediction methods
  - Computing infrastructure
  - Legacy data
  - Uncertainty
  - End-user engagement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Consortium Agreement
No. 1
between
Commonwealth Scientific and Industrial Research Organisation (in Australia),
Earth Institute at Columbia University (in USA),
Empresa Brasileira de Pesquisa Agropecuária (in Brazil),
International Union of Soil Sciences (in UK),
Institute of Soil Science, Chinese Academy of Sciences (in China),
Institut de Recherche pour le Développement (in France),
ISRIC - World Soil Information (in Netherlands),
European Union, European Commission, Joint Research Centre (in Italy), (JRC.REF No. 31703)
Natural Resource Conservation Service, US Department of Agriculture (in USA),
The University of Sydney (in Australia),
and
Tropical Soil Biology and Fertility Institute of Centro Internacional de Agricultura Tropical (in Kenya & Colombia)

FAQ 1: Who is in charge of the data for my country?

- *GlobalSoilMap.net* will not replace our existing soil databases and spatial information systems
- It is a service layer of data generated by existing systems
  - Each country can use a variety of methods to generate its part of the grid
  - Custodianship of primary data is retained by the source agency
  - *GlobalSoilMap* can be updated as new data and mapping are produced by collaborating agencies.
- A regional and global community of practice

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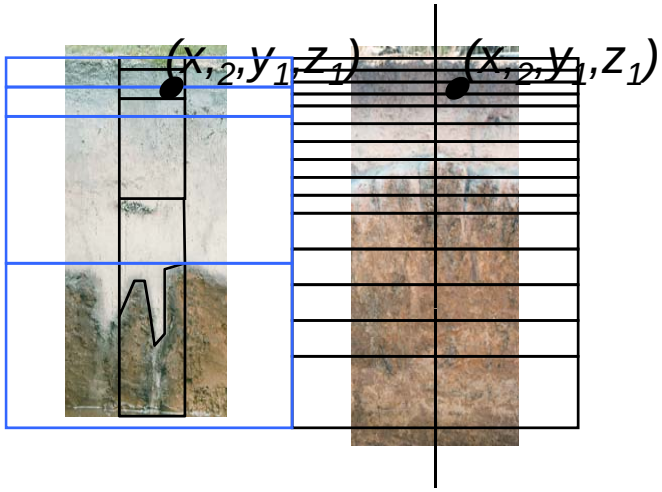
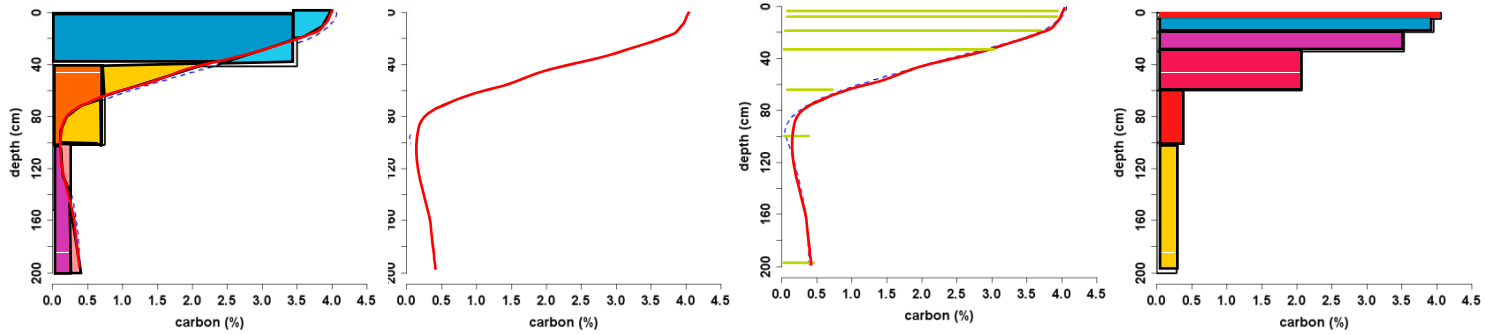
FAQ 2: Will the grid replace our polygon-based information systems?

- No, we need both – grids and polygons are complementary products
- The gridded data produced by *GlobalSoilMap.net* cannot answer all questions
- Our conventional systems for mapping polygons and classifying soils are useful for many purposes
- But we need to dramatically improve our systems for supplying polygon and profile data to users

FAQ 3: Why do we need depth functions when we already have horizons?

- Computationally efficient system for estimating soil properties over different depths and volumes
- Does not require detailed knowledge of soil horizon nomenclature for querying
- Provides a standard for defining control volumes in soils
- Allows material fluxes to be computed and mass balance preserved





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FAQ 4: How can we produce a grid at 100m resolution when our existing maps are at broad scale?

- The grid is the framework for our estimates – it does not imply that we have accurate and precise estimates for every grid cell
- Every grid cell has an estimate of uncertainty for each soil attribute
- We have traditionally expressed uncertainty using the cartographic scale of a soil map but this has drawbacks
- Broad scale maps can be used to provide grid estimates of soil attributes – they will probably have a low degree of accuracy and precision
- In other words, the *resolution* of the cell (100m) is not the measure of uncertainty

FAQ 5: Why do we need a minimum data set?

- It is easier to agree on the *minimum* data set rather than an *optimum* data set
- The users need globally consistent and manageable soil data
- We have to get some basic products delivered – other attributes can be added later
- The minimum data set characterises the master variables controlling soil behaviour (surface area, charge density, pH)
- The minimum data set will be used to derive estimates of other soil properties using pedotransfer functions

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FAQ 6: My country does not have resources to produce digital soil maps online – what do we do?

- The *GlobalSoilMap.net nodes* provide leadership and support in each region
- The support is technical (e.g. access to training and data resources) and in some cases financial
- In some regions, other countries or the local node may provide the data as a service to the country (e.g. some of the very small and poor Pacific Nations)
- Contact me or the relevant node leader if you need assistance

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FAQ 7: What is the relationship between *GlobalSoilMap.net* and the Global Soil Partnership (GSP)?

- The *GlobalSoilMap.net* Consortium is made up of the key international soil information agencies
- The *GlobalSoilMap.net* Consortium strongly supports the GSP
- *GlobalSoilMap.net* fits very well under Pillar Two of the GSP along with other soil information services
- We have prepared a draft plan for Pillar Two of the GSP
- The GSP potentially provides the long term institutional framework for supporting *GlobalSoilMap.net*

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GLOBAL SOIL PARTNERSHIP

FAQ 8: How can we help build *GlobalSoilMap.net*?

- Contact the Consortium and your regional node
- Read the Technical Specifications and develop a workflow for estimating the minimum data set and the grid for your district or country
- Work with national governments and the Consortium to develop a sustainable business model to support your inputs to *GlobalSoilMap.net*
- Welcome aboard!

The significance of this meeting

- We must provide decision makers with the scientific information needed to ensure Asia's soil resources have the capacity to support prosperous communities and countries in perpetuity
- The Technical Specifications for *GlobalSoilMap.net* are being officially launched at this important meeting
- We are moving from the research phase to the operational phase of *GlobalSoilMap.net*
- We are starting to build a much better soil information system for Asia

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