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SOIL SCIENCE 2020
& BEYOND...

REALISING THE VALUE OF SOIL
&
VALUING THOSE WHO STUDY IT

International Union of Soil Sciences
Strategic Plan
2012 - 2020

"bringing soil to life"

"valuing soil scientists"

www.iuss.org

Edited by

[Adopted by IUSS Council xxxx 2012]

The International Union of Soil Sciences (IUSS) is the global union of soil scientists. It has participation from some 130 countries involving some 50 000 soil scientists.

IUSS Mission

To promote the scientific and life-sustaining importance of soil to humankind.

To support and enhance the discipline of soil science globally

IUSS Vision

We aim to be recognized as the leading world organization for the facilitation, collection and dissemination of soil science

We strive to support and value the global community of scientists who generate soil knowledge and increase understanding of soil

We provide opportunities for all soil scientists to meet, present their work and exchange views in global and regional fora.

Overarching strategies

1 Branding soil

The value of soil to humanity and the functioning of Earth systems must be known to everyone. Soil is a well-recognised word and concept in all cultures. However the breadth of its functions and importance to society and its sustainability is less well perceived by humanity as a whole. There is a need to brand soil and make everyone on the planet aware of its virtues. The IUSS will seek to engage with global agencies, (e.g., WWF, UN bodies), to achieve this. By 2020 the IUSS will have made four strategic alliances with major global agencies specifically to brand and promulgate the virtues and vitality of soil.

2 Branding soil science

For over 150 years there has been a well defined and coordinated scientific study of soil. Soil is once again an important topic but the ongoing achievements of soil science are not as widely known as warranted. The IUSS will attempt to better brand soil science by:

- Producing a publication on soil science's top ten scientific achievements and promoting this widely through a media campaign.
- Appointing a global panel of soil scientists to highlight all urgent scientific matters relating to soil.
- Encouraging all IUSS members to comment on soil studies done by members of other non-soil scientific communities.
- Enhancing interactions and collaborations with other international unions and learned societies
- Developing universal soil science curricula that can be used and adopted at universities and training centres across the world
- Engaging the public in dialogues about the critical importance of soil science in sustaining life and serving as an engine for economic development and global sustainability.

3 Increasing participation (membership)

The International Union of Soil Sciences and its predecessor the International Society of Soil Science (ISSS) have a long history. The union is the only global organization of soil scientists and is a full and active member of the ICSU family. The IUSS is also well known in the soil science community through its World Congresses of Soil Science and many smaller conferences, meetings and seminars. The participation of individual members in the activities of IUSS is limited. An educated estimate of average activity is around 0.1 activities per member per annum. Currently, about 150 people are active in the IUSS whereas indirectly through meetings and conferences thousands of soil and other scientists participate in IUSS activities. In order to brand soil science and the IUSS, we should

like to increase the overall participation, and particularly in less developed nations by providing service and support. Strategies hereto include:

- Providing an increased service to our members with enhanced interaction and possibilities for information exchange
- Increase the frequency of World Congresses of Soil Science (WCSS) frequency to once every three years. This can include IUSS Thematic Conferences, Divisional Conferences and better recognition of larger regional conferences (e.g., EuroSoil, East and South Asia Federation of Soil Science etc.).
- Increasing the number of meetings in developing countries to 20 per year by 2020.
- Establishing a specific IUSS endowment for the participation of developing countries in World Congresses and the seeking of donations from Foundations.
- Achieving of 100 000 member hits per annum on our website by 2020. We had a total of 140k visits 5 years ago.
- Making the IUSS website the prime focal point for information exchange with our members and the general public in addition to other social media (Facebook, Twitter etc).

4 Increasing our resource base

Our current resource base is approximately $4 per national member. This is very small in comparison with some of our national societies, yet the expectation is that we provide resources and activities approximately similar to those of our national societies. We need to increase the average income per notional member to $10 by 2020 by a number of strategies:

- Increasing the number of participating countries and members per country
- Altering the fees according to a schedule, e.g., such as Indicative Payment per Member 1 or Indicative Payment per Member 2 in Appendix 1). Appendix 1 also suggests indicative membership for a large number of countries with which we are not interacting.
- Establishing an online soil science journal in conjunction with one of the major publishers (our more successful national societies are supported by a successful journal)
- Achieving philanthropic support for our activities (e.g., ~$0.5M) by 2020.

5 Improving the member experience

The service we give to our membership is dictated by our resource base and in particular by the fact that we have no permanent secretariat. The principal strategy should be the establishment of a permanent secretariat by 2016 (our more successful national societies have a permanent administrative staff funded by member subscriptions). This secretariat would maintain the website and all communications to members, national societies, other scientific unions and the general public. Inter alia, this would facilitate easier management of IUSS elections by the national societies, and access to a free online soil science journal by all members. We need to ensure pro-actively that members of affiliated national societies are also members of IUSS.

6 Improving stakeholder engagement

Soil science and soil scientists serve humanity as a whole. Our principal stakeholders excluding our members are 1) the scientific community, 2) government and non-government organisations interested in soil security and policy, 3) land managers, and 4) the general public at large. We wish to target each of these groups as follows

(1) Hold joint meetings with at least three related disciplines in the period up to 2020
(2) Develop by 2016 a formal working group on soil policy with representatives from external governmental and non-governmental organisations
(3) Produce by 2015 a booklet and web page on recent key soil science findings for land management
(4) Produce by 2015 an annual statement of three key new soil science findings for dissemination to the public

7 Strengthening linkages with international scientific organisations

IUSS is a member of the International Council of Scientific Unions (ICSU). ICSU is one of the premier bodies for scientific research in the world, incorporating most scientific disciplines. In 1993 at the ICSU General Assembly held in Santiago de Chile ISSS was accepted as a Full Member of ICSU and has taken a full and very active role, helping develop a stronger environmental awareness amongst the global scientific community. IUSS has been an active member of a small group of GeoUnions within ICSU. This group comprising Geologists, Geophysicists, Meteorologists, Astronomers, Geographers and scientists involved in remote sensing has met prior to formal and ICSU meetings as well as outside the normal cycle of meetings to ensure that the views of Earth Scientists are heard effectively within ICSU. In addition to collaborating to ensuring ICSU gives appropriate attention to matters within our scientific remits, the group have collaborated in developing policies and programs to ensure that education in the Earth Sciences is part of national educational programs across the globe. We wish to strengthen our linkages with ICSU and related organisations.

8 Committee of soil science Academicians

The IUSS will set up by 2016 a Committee of Soil Science Academicians (comprising *ex officio* those soil scientists who have been recognized by membership of their respective national academies of science) to further the cause of soil science internationally through joint efforts by national academies of science.

9 Promoting global soil instruments

Many of our cognate disciplines deal with objects which are covered by international and global treaties and conventions, e.g., water, biodiversity, food, the sea etc. Soil is not covered by any such conventions. The IUSS seeks to support international and global soil policy instruments that promote soil security. We would aim to see at least one global soil instrument in place by 2020. To help achieve this IUSS supports the activity of soil scientists in global activities such as Global Soil Partnership, Global Soil Forum, GlobalSoilMap and the Global Soil Biodiversity Initiative. In the longer term, such instruments would be served well if they were backed by a Global Soil Science Institute.

10 Education

The vibrance and future of soil science largely depends on our ability to deliver a new generation of well trained soil scientists. The discipline is rapidly evolving and there is an universal need to develop new soil science curricula that entails the basics of soil science as all as the new demands that come from society and the other scientific disciplines. Education of students about soil is a key priority and this should be done at primary and secondary schools but also in higher education.

1. We need to develop a current primary and secondary school soil curriculum and engage students
2. Develop and publish good quality photographs and landscape photos for teachers to download.
3. Create teaching resources for primary and secondary schools.
4. Create an educational website for schools
5. Explore links with national societies so that soil scientists can visit schools and give talks on soils and the landscape, creating projects linking soils with mathematics, physics, biology, chemistry, and geography.

In higher education (universities, polytechnics) we will develop global soil science curricula that can be adopted an adjusted to local and national needs and preferences. We shall also bring some of the national activities on education (e.g. soil judging) to the global level and leverage other national and regional soil science educational activities.

Noble global challenges[1]

There are a great many research challenges in soil science. Here we focus on questions that affect society as a whole; and because we believe strongly that solutions to these issues are of great benefit to humanity and the environment we deem them *Noble Challenges*.

1 Soil security

Tactical (5 years)

Soil security is an overarching concept:- maintenance or improvement of the soil system globally to meet global challenges. Development of the concept

Knowledge gap

Relationship to other multi-attribute soil evaluation concepts, e.g., soil function, soil quality etc.

Strategic (10 years)

Acceptance and dissemination of the concept with policy implications.

Knowledge gap

Recognition, measurement and interpretation of key soil attributes locally, regionally, and globally

Long-term (20 years)

Sustainable soil systems globally

Knowledge gap

Sustainability criteria for local and regional soil systems for the whole gamut of uses.

2 Food, feed, fibre and fuel security

Tactical (5 years)

Increase efficiency of biomass use

Knowledge gap

Further explore the potentials with respect to the soil resources required

Strategic (10 years)

Implement the concept of bioconversion of renewables, using starch for feed and food and the rest for materials and energy

Knowledge gap

Development of a cascade type of biomass use; explore the medium to long-term impact on soil. This relates also to Challenges 3 and 5 below.

Long-term (20years)

Implement methods of gene technology into the bioconversion of renewables

Knowledge gap

Impact assessment on soil systems

[1] Based, with grateful thanks, on the Soil Science Society of America's Grand Challenges

3 Climate change and adaptation

Tactical (5 years)

Addition of exogenous chars has the capacity to increase soil carbon sequestration.

Knowledge gap

There is a need to discover the mechanisms, co-benefits and economics of char addition, as well as the pitfalls. On all timescales we need research on climate change impacts on soils and the impact of soils on climate change.

Strategic (10 years)

Cryosols are thawing due to global warming, resulting in significant emissions of greenhouse gases, most notably methane. We should add "methanosols" – on brownfields and waste deposits.

Knowledge gap

We need to determine the mechanisms controlling greenhouse gas emissions from organic soil, particularly those in very cold climates, and identify methods to control those emissions. See above

Long-term (20years)

World agriculture contributes x% of annual greenhouse gas emissions. Managed ecosystems (crops, pastures and forests) have the capacity to be net sinks if appropriately treated.

Knowledge gap

We need to identify key biogeochemical soil processes controlling soil carbon storage and emission of pedogenic greenhouse gases (CO_2, CH_4 and N_20) from managed ecosystems in order to develop appropriate management practices to reduce emissions and increase carbon capture.

4 Global soil information

Tactical (5 years)

Global information system of world's key soil resources at moderate spatial resolution (100 m).

Knowledge gap

Extent of global legacy soil data. Methods for data rescue and updating.

Strategic (10 years)

Updating global soil information to a common datum (2020)

Knowledge gap

Design of appropriate sampling schemes and methodologies for filling information gaps and harmonization to a common datum

Long-term (20 years)

Continuous integrated global monitoring of soil at high spatial and temporal resolution

Knowledge gap

Key soil properties, design of network, measurement and sensing technologies

5 Further noble global challenges

In addition IUSS will though its Divisions develop plans for the following:- Human nutrition and health, Water security, Ecosystem health and Biodiversity conservation.

Appendix 1

	GDP per capita ($)[2]	Indicative payment per member 1[3]	Indicative payment per member 2[4]	Indicative number of members[5]
Afghanistan	**998**	**2**	**2**	**150**
Albania	**7,381**	**2**	**2**	**35**
Algeria	**7,103**	**2**	**2**	**300**
Angola	**6,412**	**2**	**2**	**250**
Antigua and Barbuda	**16,566**	**4**	**4**	**5**
Argentina	**15,603**	**4**	**4**	**300**
Armenia	**5,178**	**2**	**2**	**30**
Australia	**39,692**	**9**	**11**	**600**
Austria	**39,454**	**9**	**11**	**150**
Azerbaijan	**9,953**	**2**	**2**	**100**
Bahamas, The	**25,884**	**6**	**7**	**15**
Bahrain	**26,807**	**6**	**8**	**1**
Bangladesh	**1,565**	**2**	**2**	**150**
Barbados	**22,296**	**5**	**6**	**5**
Belarus	**13,864**	**3**	**4**	**150**
Belgium	**36,274**	**8**	**10**	**150**
Belize	**7,894**	**2**	**2**	**5**
Benin	**1,453**	**2**	**2**	**50**
Bhutan	**5,533**	**2**	**2**	**15**
Bolivia	**4,584**	**2**	**2**	**200**
Bosnia and Herzegovina	**7,751**	**2**	**2**	**50**
Botswana	**15,449**	**4**	**4**	**150**
Brazil	**11,289**	**3**	**3**	**1500**
Brunei	**47,200**	**11**	**14**	**10**
Bulgaria	**12,052**	**3**	**3**	**100**
Burkina Faso	**1,341**	**2**	**2**	**60**
Burma	**1,246**	**2**	**2**	**200**
Burundi	**410**	**2**	**2**	**10**
Cambodia	**2,086**	**2**	**2**	**90**
Cameroon	**2,165**	**2**	**2**	**150**
Canada	**39,033**	**9**	**11**	**1100**

[2] 2010
[3] Based on a ratio of GDP per capita to that of Qatar times $25, rounded and with a minimum of $2
[4] Based on 0.03% of GDP percpita, rounded and with a minimum of $2
[5] Based on a formal relationship between no of members and GDP per capita, population, land area and production. This is to give an indication for many countries for which we have no or little data. The ratio of the actual no of members to indicative number may be seen as a measure of the degree of development of the respective national society. This may be an underestimate, it estimates the total no of members to be 40 000 worldwide.

Cape Verde	**3,562**	**2**	**2**	**1**
Central African Republic	**764**	**2**	**2**	**60**
Chad	**1,653**	**2**	**2**	**150**
Chile	**14,982**	**3**	**4**	**250**
China, People's Republic of	**7,518**	**2**	**2**	**5500**
Colombia	**9,445**	**2**	**2**	**300**
Comoros	**1,176**	**2**	**2**	**5**
Congo, Democratic Republic of the	**340**	**2**	**2**	**200**
Congo, Republic of the	**4,487**	**2**	**2**	**100**
Costa Rica	**10,732**	**2**	**3**	**70**
Côte d'Ivoire	**1,686**	**2**	**2**	**150**
Croatia	**17,608**	**4**	**5**	**90**
Cyprus	**28,045**	**6**	**8**	**20**
Czech Republic	**24,987**	**6**	**7**	**150**
Denmark	**36,764**	**8**	**11**	**100**
Djibouti	**2,553**	**2**	**2**	**5**
Dominica	**10,456**	**2**	**3**	**5**
Dominican Republic	**8,647**	**2**	**2**	**80**
Ecuador	**7,951**	**2**	**2**	**150**
Egypt	**6,367**	**2**	**2**	**300**
El Salvador	**7,442**	**2**	**2**	**45**
Equatorial Guinea	**18,387**	**4**	**5**	**25**
Eritrea	**676**	**2**	**2**	**30**
Estonia	**18,274**	**4**	**5**	**45**
Ethiopia	**1,018**	**2**	**2**	**200**
Fiji	**4,450**	**2**	**2**	**10**
Finland	**34,401**	**8**	**10**	**200**
France	**34,092**	**8**	**10**	**300**
Gabon	**14,865**	**3**	**4**	**100**
Gambia, The	**1,972**	**2**	**2**	**5**
Georgia	**5,057**	**2**	**2**	**60**
Germany	**35,930**	**8**	**10**	**300**
Ghana	**1,609**	**2**	**2**	**100**
Greece	**28,833**	**7**	**8**	**200**

Grenada	**10,881**	**2**	**3**	**10**
Guatemala	**4,871**	**2**	**2**	**100**
Guinea	**1,056**	**2**	**2**	**70**
Guinea-Bissau	**1,082**	**2**	**2**	**10**
Guyana	**6,893**	**2**	**2**	**50**
Haiti	**1,121**	**2**	**2**	**25**
Honduras	**4,404**	**2**	**2**	**80**
Hong Kong	**45,277**	**10**	**13**	**25**
Hungary	**18,815**	**4**	**5**	**150**
Iceland	**36,681**	**8**	**11**	**50**
India	**3,290**	**2**	**2**	**1000**
Indonesia	**4,380**	**2**	**2**	**300**
Iran	**11,024**	**2**	**3**	**300**
Iraq	**3,599**	**2**	**2**	**200**
Ireland	**38,685**	**9**	**11**	**150**
Israel	**29,404**	**7**	**8**	**90**
Italy	**29,418**	**7**	**8**	**300**
Jamaica	**8,811**	**2**	**2**	**20**
Japan	**33,828**	**8**	**10**	**300**
Jordan	**5,658**	**2**	**2**	**80**
Kazakhstan	**12,401**	**3**	**3**	**300**
Kenya	**1,784**	**2**	**2**	**200**
Kiribati	**6,181**	**2**	**2**	**5**
Korea, South	**29,791**	**7**	**8**	**250**
Kuwait	**38,293**	**9**	**11**	**60**
Kyrgystan	**2,162**	**2**	**2**	**70**
Laos	**2,435**	**2**	**2**	**80**
Latvia	**14,330**	**3**	**4**	**60**
Lebanon	**15,331**	**3**	**4**	**40**
Lesotho	**1,266**	**2**	**2**	**10**
Liberia	**396**	**2**	**2**	**20**
Libya	**14,878**	**3**	**4**	**250**
Lithuania	**16,997**	**4**	**5**	**80**
Luxembourg	**80,304**	**18**	**24**	**10**
Macedonia, Republic of	**9,350**	**2**	**2**	**30**
Madagascar	**910**	**2**	**2**	**100**
Malawi	**908**	**2**	**2**	**60**
Malaysia	**14,603**	**3**	**4**	**250**
Maldives	**5,483**	**2**	**2**	**5**
Mali	**1,206**	**2**	**2**	**150**
Malta	**24,081**	**5**	**7**	**1**
Mauritania	**2,099**	**2**	**2**	**100**
Mauritius	**13,214**	**3**	**3**	**5**

Mexico	**14,266**	**3**	**4**	**350**
Moldova	**2,959**	**2**	**2**	**25**
Mongolia	**3,727**	**2**	**2**	**150**
Montenegro	**10,432**	**2**	**3**	**10**
Morocco	**4,773**	**2**	**2**	**200**
Mozambique	**982**	**2**	**2**	**150**
Namibia	**6,945**	**2**	**2**	**150**
Nepal	**1,250**	**2**	**2**	**100**
Netherlands	**40,777**	**9**	**12**	**150**
New Zealand	**27,460**	**6**	**8**	**150**
Nicaragua	**2,969**	**2**	**2**	**70**
Niger	**720**	**2**	**2**	**150**
Nigeria	**2,398**	**2**	**2**	**300**
Norway	**52,238**	**12**	**15**	**200**
Oman	**26,197**	**6**	**7**	**150**
Pakistan	**2,789**	**2**	**2**	**300**
Panama	**12,397**	**3**	**3**	**80**
Papua New Guinea	**2,302**	**2**	**2**	**100**
Paraguay	**4,915**	**2**	**2**	**150**
Peru	**9,281**	**2**	**2**	**300**
Philippines	**3,725**	**2**	**2**	**250**
Poland	**18,837**	**4**	**5**	**250**
Portugal	**23,113**	**5**	**6**	**150**
Qatar	**88,232**	**20**	**26**	**60**
Republic of China (Taiwan)	**34,743**	**8**	**10**	**150**
Romania	**11,766**	**3**	**3**	**200**
Russia	**15,807**	**4**	**4**	**3000**
Rwanda	**1,202**	**2**	**2**	**25**
Saint Kitts & Nevis	**12,976**	**3**	**3**	**10**
Saint Lucia	**10,227**	**2**	**3**	**5**
Saint Vincent & the Grenadines	**10,261**	**2**	**3**	**5**
Samoa	**5,731**	**2**	**2**	**1**
São Tomé and Príncipe	**1,879**	**2**	**2**	**10**
Saudi Arabia	**23,742**	**5**	**7**	**300**
Senegal	**1,814**	**2**	**2**	**90**

Serbia	**10,808**	**2**	**3**	**100**
Seychelles	**24,837**	**6**	**7**	**5**
Sierra Leone	**803**	**2**	**2**	**25**
Singapore	**57,238**	**13**	**17**	**20**
Slovakia	**22,267**	**5**	**6**	**100**
Slovenia	**27,899**	**6**	**8**	**50**
Solomon Islands	**2,974**	**2**	**2**	**5**
South Africa	**10,505**	**2**	**3**	**300**
Spain	**29,651**	**7**	**8**	**300**
Sri Lanka	**5,103**	**2**	**2**	**100**
Sudan	**2,466**	**2**	**2**	**300**
Surinam	**8,955**	**2**	**2**	**40**
Swaziland	**5,884**	**2**	**2**	**15**
Sweden	**37,775**	**9**	**11**	**250**
Switzerland	**41,765**	**9**	**12**	**150**
Syria	**5,108**	**2**	**2**	**150**
Tajikistan	**1,907**	**2**	**2**	**60**
Tanzania	**1,497**	**2**	**2**	**200**
Thailand	**8,643**	**2**	**2**	**300**
Timoe Leste	**2,663**	**2**	**2**	**5**
Togo	**847**	**2**	**2**	**25**
Tonga	**7,134**	**2**	**2**	**5**
Trinidad and Tobago	**20,137**	**5**	**6**	**15**
Tunisia	**9,488**	**2**	**2**	**150**
Turkey	**13,392**	**3**	**4**	**300**
Turkmenistan	**6,597**	**2**	**2**	**150**
Uganda	**1,245**	**2**	**2**	**100**
Ukraine	**6,665**	**2**	**2**	**250**
United Arab Emirates	**36,973**	**8**	**11**	**150**
United Kingdom	**35,053**	**8**	**10**	**300**
United States	**47,123**	**11**	**14**	**6500**
Uruguay	**14,342**	**3**	**4**	**100**
Uzbekistan	**3,022**	**2**	**2**	**200**
Vanuatu	**4,807**	**2**	**2**	**1**
Venezuela	**11,889**	**3**	**3**	**300**
Vietnam	**3,123**	**2**	**2**	**200**
Yemen	**2,595**	**2**	**2**	**150**
Zambia	**1,625**	**2**	**2**	**150**
Zimbabwe	**395**	**2**	**2**	**60**