



Promoting Cooperative Solutions for Space Sustainability

Small Satellites & International Development

Krystal Wilson, Director of Space Applications Programs

Secure World Foundation

PECORA 21, ISRSE 38

Baltimore, Maryland

October 9, 2019



Promoting Cooperative Solutions for Space Sustainability

Secure World Foundation

Secure World Foundation is a **private operating foundation** that promotes cooperative solutions for space sustainability

- Why **space sustainability**? Increasing reliance on space assets coupled with potentially destabilizing trends
- **Our mission:** To work with governments, industry, international organizations, and civil society to develop and promote ideas and actions to achieve the secure, sustainable, and peaceful uses of outer space benefiting Earth and all its peoples

- The Foundation acts as a **research body, convener and facilitator** to examine key space policy topics
 - To promote **international cooperative governance** for increased space sustainability
 - To increase **human and environmental security** by promoting improved governance of the delivery of information gathered from space systems in ways that promote its utility
 - To assist in the **development of effective national and international space policies and laws** both in established and emerging space nations
- Offices located in Broomfield, CO & Washington, DC with 11 staff members

Activities and Partners



UNITED NATIONS
Office for Outer Space Affairs



**INTERNATIONAL
ASTRONAUTICAL
FEDERATION**



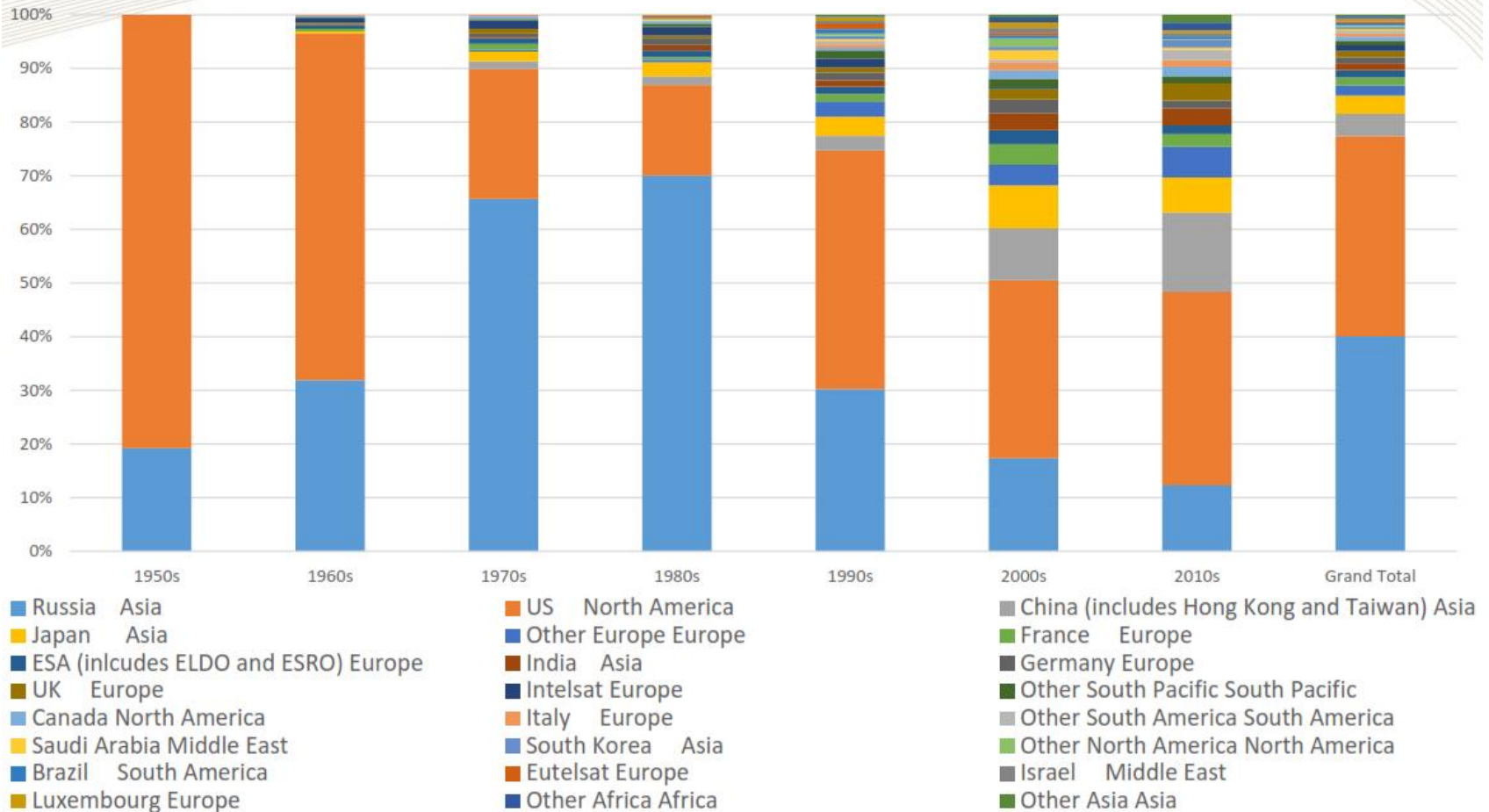
**SPACE GENERATION
ADVISORY COUNCIL**

- Space is becoming more **globalized**
 - Growing access to space technology
 - Growing interest by many countries in utilizing space for national benefits (socioeconomic development, prestige, national security)
- Space is becoming more **diverse**
 - Space began as part of competition between governments (US and USSR)
 - Influx of technology, talent, and capital from other sectors (IT, analytics, etc)

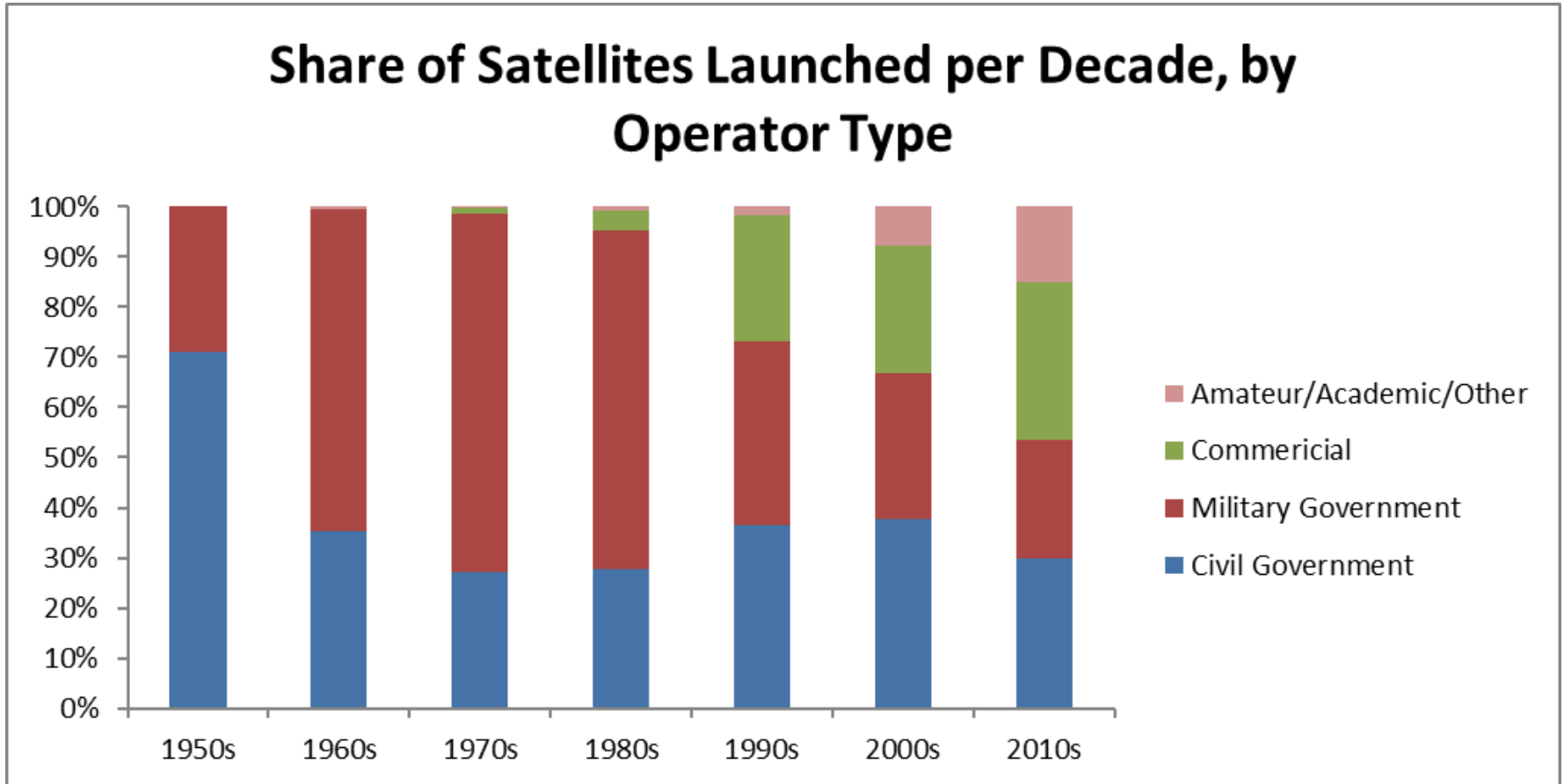
How can SDG implementers and other international development actors leverage on the changing space landscape?

More International

Satellites by Owner Country -1950s-today



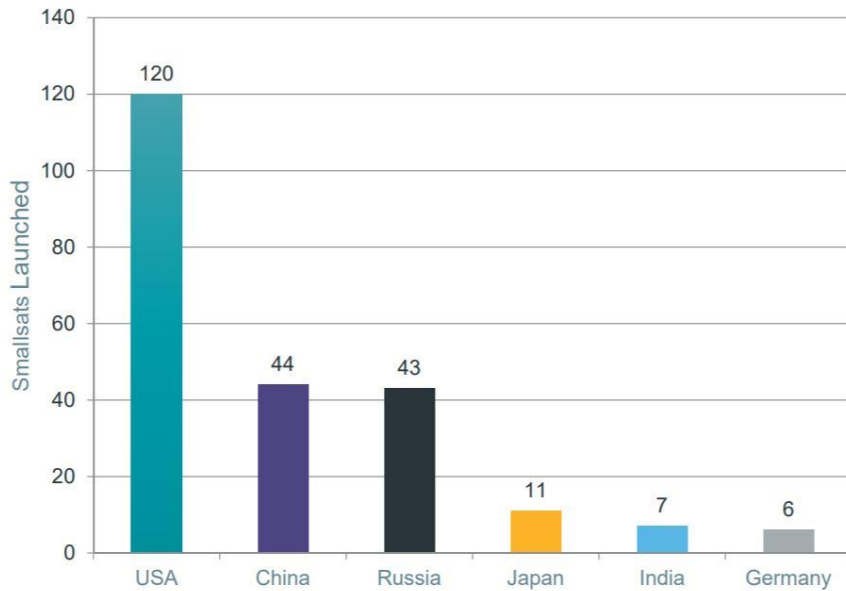
Source: Adapted from [IDA Global Trends in Civil and Commercial Space Study](#)



Source: McDowell, Jonathan C, 2017—Satellite Statistics http://www.planet4589.org/space/log/stats2/own_categ.txt


New National Entrants

Countries Deploying the Most Government Smallsats, 2012 - 2018



Source: Bryce Space and Technology "Small Satellites By the Numbers 2019"

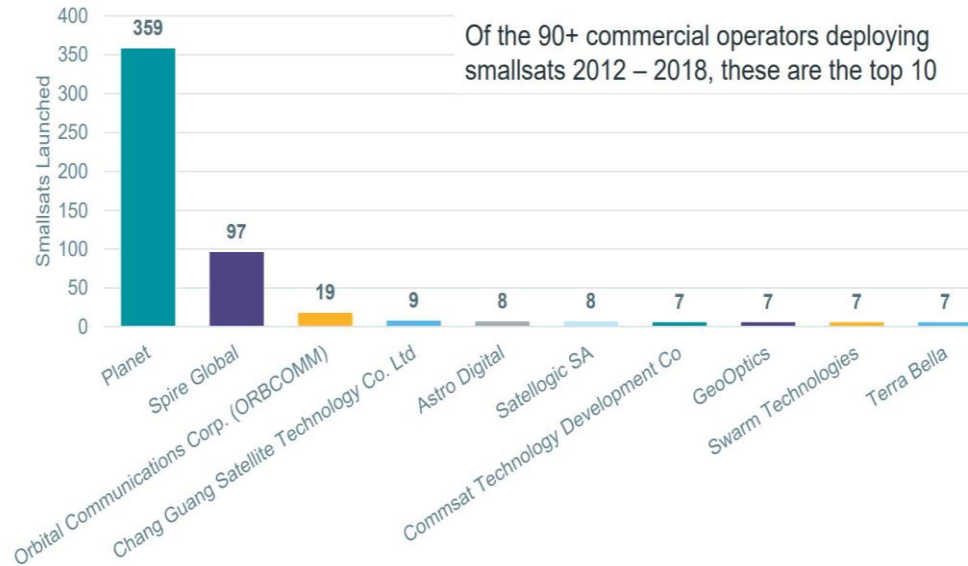
5 or Fewer Government Smallsats Deployed	
South Korea	Ecuador
Australia	Indonesia
European Space Agency	Spain
Canada	Kazakhstan
Israel	Turkey
Iran	Peru
Brazil	Greece
Algeria	Taiwan
North Korea	Vietnam
Saudi Arabia	Belarus
UAE	Pakistan
Italy	Philippines
France	Colombia
Poland	Malaysia
United Kingdom	

Commercial Satellites

	Operational	Planned	High Res (<1m)	High revisit (<1day)	Sensor Description	System Size	Sat Mass (kg)
Large Sats	Operational		●		Airbus D&S	4	1,000
	Operational		●	●	DigitalGlobe	5	2,800
	Operational		●	●	MDA	1	2,300
	Operational		●		DMCii	6	450
	Operational		●		ImageSat	3	350
	Planned		●	●	UrtheCast	24	1,400
Small Satellites (<200 kg)	Planned		●	●	Astro Digital	30	20
	Planned		●	●	Axelspace	50	95
	Operational		●	●	BlackBridge (Planet)	5	150
	Planned			●	BlackSky Global	60	50
	Planned			●	Capella Space	30	TBD
	Planned		●		XpressSAR	4	TBD
	Planned			●	GeoOptics	24	115
	Planned		●	●	HawkEye360	21+	TBD
	Planned		●	●	Hera Systems	48	24
	Planned		●	●	ICEYE	50	<100
	Planned		●	●	PlanetIQ	12	22
	Planned		●	●	Planetary Resources	10	TBD
	Operational		●	●	Planet	100+	3
	Planned		●	●	Satelllogic	25+	35
	Operational				Spire Global	50	3
Operational			●	Terra Bella (Planet)	24	120	

Commercial Operators Launching the Most Smallsats, 2012 - 2018

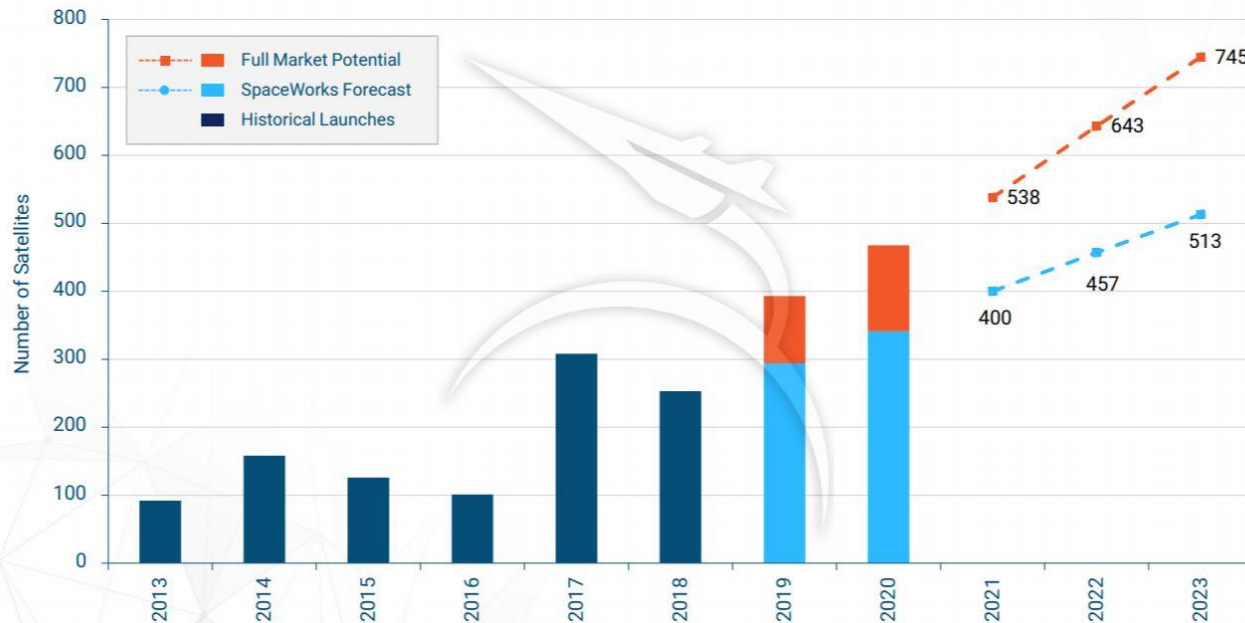


Source: Bryce Space and Technology "Small Satellites By the Numbers 2019"

Source: Satellite Industry Association "State of the Satellite Industry Report"
<https://www.sia.org/wp-content/uploads/2017/07/SIA-SSIR-2017.pdf>

SATELLITE LAUNCH HISTORY & MARKET FORECAST

Nano/Microsatellites (1 – 50 kg)



Source: Spaceworks
Enterprises, 2019
Nano/MicroSatellite
Market Forecast

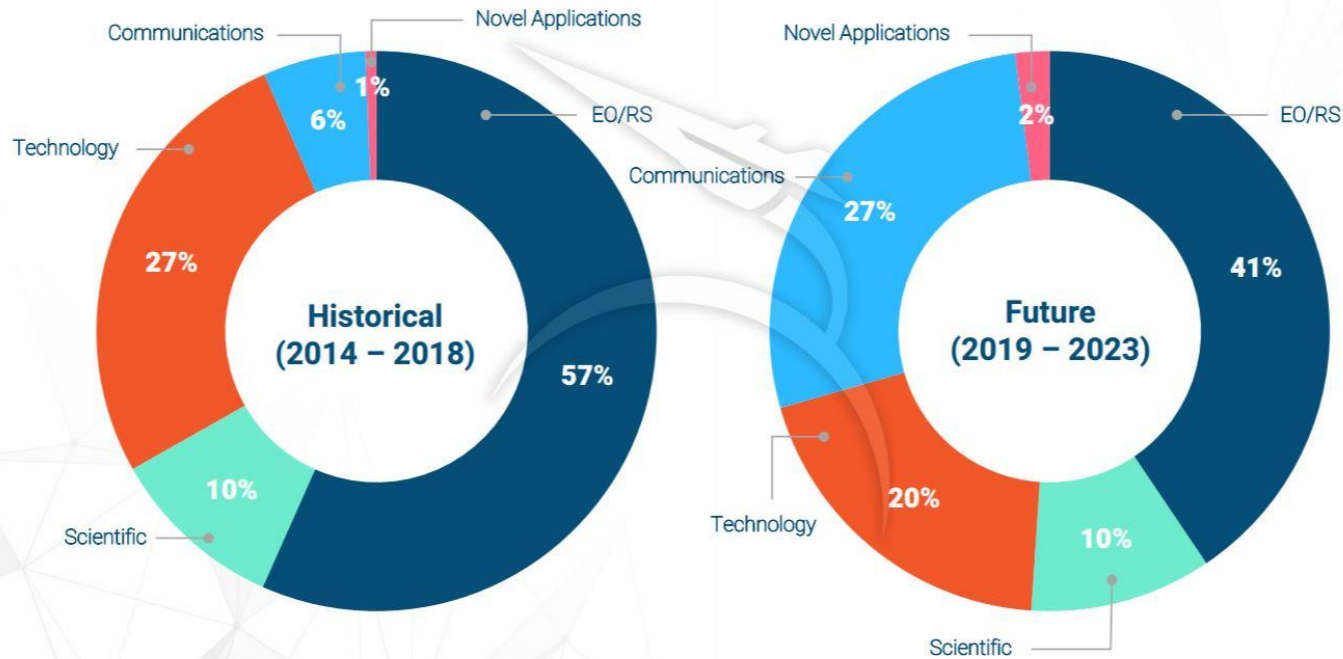
Launched in 2018: More than 250

Forecast: Up to 2800 micro/nanosatellites to launch in the next 5 years

Mega-constellations: 16,000+ planned satellites, many not included in above

SATELLITE APPLICATION TRENDS

Nano/Microsatellites (1 – 50 kg)



Source: Spaceworks Enterprises, 2019 Nano/MicroSatellite Market Forecast

How does this predicted shift affect efforts for supporting international development?

SUSTAINABLE DEVELOPMENT GOALS



You are here:
Technology News / News-Analysis

National space agencies of Asia-Pacific countries look to develop satellites in collaboration

News-Analysis | IANS | Nov 17, 2017 23:12 PM IST

In a first-of-its-kind initiative, the national space agencies of the Asia-Pacific region are looking collaboratively developing small and cube satellites, a senior Indian space official said on Friday.



Heads of space agencies from 10 countries in the region along with various government bodies had come for a session of the Asia Pacific Regional Space Agency Forum was held here from 14-17 November.

At the forum, working groups with space representatives



GIS & Maps Earth Observation GNSS & Positioning LIDAR Location Tech UAVs BIM & Modelling

Home > Blogs > Observing the Earth, Fueling Global Development Solutions

Observing the Earth, Fueling Global Development Solutions

By Anne Hale Miglarese | April 3, 2018

SHARE    

Radiant.Earth's mission is to make [Earth observation \(EO\)](#) imagery and data available to discover, analyze and apply for unique insights to the issues the global development community encounters daily. The science of remote sensing and the Earth observation marketplace is evolving rapidly given the innovations of cloud computing, machine learning and big data.



Space essential for meeting South Africa's economic and social development goals



The New Times

News Opinions Sports Lifestyle Events TimesTV

Rwanda looks to deploy satellite tech to monitor progress on SDGs

Rwanda is currently readying itself for satellite technology as one of the key tools to monitor implementation of the Sustainable Development Goals (SDGs) in the country.

By Athan Tashobya | Published: March 13, 2018



How do we take advantage of these trends for international development?

Opportunities

- Lower costs of access to space technology
- Lower technical and scientific barriers
- Broaden and diversify actors and users
- Enable new applications and services
- SmallSat companies with benefit-driven missions

What can industry and academia be doing now to address these challenges?

Who are the decision makers?

- No SDG contains goals that weren't already being worked on by professionals around the world
- Need to define and think broadly from citizens to organizations to governments
- Most potential end users are unaware of the possibilities

How are we delivering it?

- What happens when a potential end user googles their specific topic?
- Who isn't represented in this room? Are these technologies and data represented in other rooms?
- Are resources being developed that can be understood and acted upon by non-geospatial professionals? What about new communication technologies?



Space Infrastructure

- Space Agencies
- Manufacturers
- Satellite Operators
- Launch
- Investors



Downstream

- Analytics Companies
- Nat'l Statistics Agencies
- Nat'l EO Agencies
- Ground Segment
- Academia
- Hardware vendors



End Users

- Gov't Service Agencies
- NGOs
- Donors
- INGOS
- Local civil society
- Contractors

Awareness and use of Earth observation and other space-derived technology is increasing but wide-spread adoption is still slow. Why?

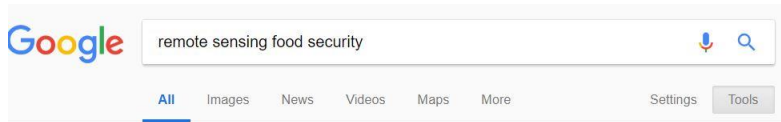
- Lack of technical knowledge or training
- Focus on traditional areas of application
- “Inertia”
- Donor skepticism
- Time and money
- Data set integration concerns including privacy
- Open data “vs.” Commercial data
- Too much data, not the right data
- Licensing



Promoting Cooperative Solutions for Space Sustainability

What happens when you Google it?

Food Security



Any time ▾ All results ▾

- ✓ **Scholarly articles for remote sensing food security**
Precision agriculture and **food security** - Gebbers - Cited by 326
... resources and **food security**: how can **remote sensing** ... - Thenkabail - Cited by 42
... advanced **remote sensing** and non-**remote sensing** ... - Thenkabail - Cited by 58
- ✓ **How Remote Sensing Can Help Address Food Security Around the ...**
<https://www.nasa.gov/.../how-remote-sensing-can-help-address-food-security-around-t...>
May 28, 2014 - When floods, droughts, and other natural disasters hit isolated and poor regions of the world, it can have devastating impacts on the local price of **food**. Research scientist Molly Brown, of NASA's Goddard Space Flight Center in Greenbelt, Maryland, is using satellite data to ...
- ✓ **Remote Sensing in Food Production and Food Security - MDPI**
www.mdpi.com/journal/remotesensing/special_issues/rs_food_production_security ▾
Dear Colleagues, **Food security** is one of the most essential factors for our physical wellbeing; it is a fundamental prerequisite for a healthy and happy life. Food ...
- ✓ **Satellite Remote Sensing in Agriculture and Food Security Assessment**
<https://www.sciencedirect.com/science/article/pii/S1878029615005551>
by ME Brown - 2015 - Cited by 2 - Related articles
NASA provides daily satellite **remote sensing** observations on a wide variety of environmental parameters at the global scale, including rainfall, temperature, ...
- ✓ **Remote sensing of crop health for food security in Africa: Potentials ...**
<https://www.sciencedirect.com/science/article/pii/S2352938517301465>
by M Onesimo - 2017 - Related articles
Accurate and timely detection, mapping and monitoring of crop diseases and pests is critical for **food security**, particularly in sub-Saharan Africa where hunger ...
- ✓ **GIS Remote Sensing in Food Security | ReliefWeb**
<https://reliefweb.int/training/2462044/gis-remote-sensing-food-security> ▾
Feb 14, 2018 - GIS AND REMOTE SENSING IN FOOD SECURITY PROGRAMME. The main purpose of the course is to enhance the capabilities of technical ...
Jun 18 - Jun 29 on-site
- ✓ **Remote Sensing of Agriculture for Food Security Monitoring in the ...**
<https://earthzine.org/.../agriculture-and-food-availabilityremote-sensing-of-agriculture...> ▾
Feb 8, 2010 - Agriculture and Food Availability – **Remote Sensing** of Agriculture for Food ... The recent global food crisis brought **food security** issues to the ...
- [PDF] ✓ **Remote sensing: a key tool for monitoring food resources in a ...**
www.kaowarsom.be/documents/Conferences/DUCHEYNE.pdf ▾
by El Ducheyne - Related articles
Keywords: **Remote Sensing**, food production, crop and livestock production ... livestock is an important resource that contributes to **food security**, improves the.

Land Degradation



About 10,300,000 results (0.45 seconds)

- ✓ **What do four decades of earth observation tell us about land ...**
blog.worldagroforestry.org/.../what-do-four-decades-of-earth-observation-tell-us-abo... ▾
Jul 10, 2015 - The team used a method known as **Earth Observation**, to collect **data** using **remote sensing** techniques, to assess the **land degradation** ...
- ✓ **Use of earth observation satellite data for land degradation ... - NCBI**
<https://www.ncbi.nlm.nih.gov/pubmed/24197846> ▾
by J Hill - 1995 - Cited by 22 - Related articles
Environ Monit Assess. 1995 Jan;37(1-3):143-58. doi: 10.1007/BF00546886. Use of **earth observation** satellite **data** for **land degradation** mapping and monitoring ...
- ✓ **Use of earth observation satellite data for land degradation mapping ...**
<https://link.springer.com/article/10.1007/BF00546886> ▾
by J Hill - 1995 - Cited by 22 - Related articles
The degradation of the permanent seminatural vegetation and the resulting acceleration of **soil degradation** and erosion processes constitute major elements of ...
- ✓ **Earth Observations for Geohazards, Land Degradation and ...**
<https://www.earthobservations.org/activity.php?id=88> ▾
Current and emerging **Earth Observation** (EO) technologies have the potential ... such as: landslide and subsidence dynamics, **soil degradation** and contamination due ... and **data** sets and plans for integration of new generation satellite **data**; ...
- [PDF] ✓ **What Four Decades of Earth Observation Tell Us about Land ... - ...**
www.mdpi.com/2072-4292/7/4/4048/pdf ▾
by C Mbow - 2015 - Cited by 38 - Related articles
Apr 2, 2015 - (4) fill **data** gaps, (5) agree on scales and assumptions, (6) set up a ... Keywords: Sahel; **land degradation**; desertification; **remote sensing**; ...
- ✓ **What Four Decades of Earth Observation Tell Us about Land ... - MDPI**
www.mdpi.com/2072-4292/7/4/4048 ▾
by C Mbow - 2015 - Cited by 38 - Related articles
Apr 2, 2015 - The assessment of **land degradation** and the quantification of its effects on land ... After four decades of **Earth Observation** (EO) applications, little ... **data**-access, (4) fill **data** gaps, (5) agree on scales and assumptions, (6) set ...
- ✓ **The role of Remote Sensing in land degradation assessments ...**
<https://www.tandfonline.com/doi/full/10.1080/22797254.2017.1378926>
by O Dubovyk - 2017 - Related articles
Sep 18, 2017 - **Land degradation** (LD) is one of the biggest global challenges for the people's ... Currently, **Remote Sensing data** are featured by satellite ...
- ✓ **Use of Earth Observation Satellite Data for Land Degradation ...**
https://www.researchgate.net/.../258336842_Use_of_Earth_Observation_Satellite_Data...
Dec 20, 2017 - Download citation | Use of **Earth Observa...** | The **degradation** of the permanent seminatural vegetation and the resulting acceleration of **soil** ...

- More general resources which outline the “what” and the “how”
- Increased collaboration among a wider range of stakeholders
- More support for sector cross-training, both academically and professionally
- Better engagement with media
- Don’t let “perfect” or “most efficient” be the enemy of “good” and “effective”
- Leveraging corporate social responsibility principles
- Take advantage of existing skills sets and synergies



Promoting Cooperative Solutions for Space Sustainability

Secure World Foundation's Efforts

Past Events:

- **Global Space Applications Conference 2018** in May in Montevideo, Uruguay
- **Student Generation Advisory Council Space Generation Congress** in October 2018 in Bremen, Germany
- **SmallSat Conference** in August 2019 in Logan, Utah

Upcoming:

- **Space Symposium** in April 2020 in Colorado Springs
- **1st IAA African Symposium on Small Satellites - Space for Sustainable Development** in Africa in May 2020 in Capetown, South Africa
- **SmallSat Conference** in August 2020 in Logan, Utah



Promoting Cooperative Solutions for Space Sustainability

Questions?

Thanks.

kwilson@swfound.org