Community remote sensing legal issues

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1. Introduction: what is Community Remote Sensing?

Community Remote Sensing (CRS) can be defined as: “Location technology that combines remote sensing with citizen science, social networks and crowd-sourcing to enhance the data obtained from traditional sources. It includes the collection, calibration, analysis, communication or application of remotely sensed information by these community means”.

Citizen science is a term used for scientific projects in which individual volunteers or networks of volunteers perform or manage research-related tasks such as observation, measurement or computation. The term crowdsourcing comes from the concept of outsourcing, but in crowdsourcing the call for work is open to an undefined, large group of people or community (a "crowd"). These concepts rely essentially on the fact that because it is open to volunteers, it gathers those who are most fit to perform tasks, solve complex problems and contribute with the most relevant and fresh ideas. Social networks, which gather people sharing one or more common interest, help spreading the call and locating interested volunteers.

CRS is not a new technology, it is a new use of a combination of technologies and it is capitalizing on existing technologies. For example, CRS may combine GPS localization, text messaging and Twitter to report ground-level activities in real-time and near-time for quick analysis of a natural or man-made situation.
Following the satellite revolution, CRS might be the new revolution for enhancing our understanding of Planet Earth, by making more useful local information available in a shorter time.

An example of local information that would be unavailable without CRS is the IBM initiative called Creek Watch. This new iphone application allows its users to help protect and conserve their local waterways in just a few minutes. All they have to do is to regularly take a picture of a waterway using the iphone and its integrated GPS, and report on the water level (dry, some or full), flow rate (still, slow or fast) and the amount of trash (none, some or a lot). All the information gathered in this way is then aggregated on an interactive map, which can then be used by water-protection entities worldwide[1]. Many citizen science projects like this exist, allowing anyone with an interest in nature preservation to help the advancement of science[2].

[1] http://creekwatch.researchlabs.ibm.com/
[2] http://www.scienceforcitizens.net/

But CRS can also involve remote sensing professionals on a volunteer basis, especially for humanitarian purposes and disaster management. A good example of this is the creation of the GISCorps[3] where volunteer experts collaborate on-line through wikis to produce information about a disaster-struck area. Even with just a few volunteers working around the world in their various time zones, information derived from satellite data can be produced very quickly and sent to relief workers to help them prioritize responses and understand the local situation. The GISCorps has immediately taken action after the recent earthquake in Japan[4].

Community remote sensing is a very broad concept, adding on to traditional remote sensing, but it always has as a common ground, the fact that citizens participate in science and disaster management, by helping create better information, in a faster and cheaper way.

2. Legal issues arising at each step of CRS

At each stage of CRS, legal issues may arise that need to be taken into account. These steps – data collection, data access and usage and finally sharing and distribution of data and/or information – are similar to any remote sensing project. In the case of CRS however, many different types of data may be compiled and the purpose of it is usually wide distribution and sharing. Some legal threats are therefore particularly important in the case of CRS, and can usually be found under four main legal concerns: privacy, intellectual property rights, liability and national security[5].

Failure to address these legal issues when considering a community remote sensing initiative may eventually harm the project or have negative impacts on future projects. It may for example lead governments to implement restrictions, or reduce the willingness of some stakeholders to share information, or even raise the cost of access to certain data. Awareness of the potential legal consequences at stake is the first necessary step, which may help reduce legal risks from the beginning. Pinpointing the legal issues and their practical consequences is also necessary in order to address them in future legislation and policies.

This table summarizes the major legal issues arising at each step, which will be discussed in detail in this section:

Steps	Legal issues
Data collection	National security and privacy

[3] http://www.giscorps.org
[4] For an example of a CRS interactive map of the Japanese earthquake: http://www.esri.com/services/disaster-response/japan-earthquake-tsunami-2011-map/index.html
[5] Kevin Pomfret, *Legal and Policy Issues Associated with Community Remote Sensing*, presented at the 2010 IEEE International Geoscience and Remote Sensing Symposium (IGARSS).

Data access and usage	Intellectual property rights (licenses)
Data distribution and sharing	Intellectual property rights and liability

a. Data Collection

One of the particularities of CRS is that it uses multiple types of data and sources. Data typically used can be divided into four main categories:

- Satellite images: these can be low or high resolution, current or archived and coming from different types of sensors.
- Aerial images
- Ground data: in-situ observations, GPS waypoints, photographs, and even old maps or archived drawings.
- Social network information, like Twitter or text messages.

Analyzing and combining all or some of these different types of data creates a new set of data from which information can be extracted leading to new knowledge. It is the fact of combining all this information that creates a more accurate picture of the situation at hand, whether it is for humanitarian response after a natural disaster, for a scientific study of an ecosystem, for an applied use such as microweather predictions in mountainous country, or many other uses.

Depending on the CRS project, several legal issues may arise as early as the data collection stage. Some data may not be easily available, and this should be taken into account before starting a CRS initiative. This is particularly true for satellite and aerial images. There are two main issues that can be found: national security and cost-related issues. If the data needed comes from a governmental satellite with an open access policy, is low-resolution and dates back ten years, it should be very easy to collect. If the resolution needed is high or very high, more restrictions are likely to exist, either national security related or cost related, as most of the high-resolution data come from commercial satellites.
For aerial images, their collection might be difficult as heavy restrictions exist in some countries that deny authorization for aerial photography of their territory. These images are usually also more costly to gather.

Yet, it is also important to note that in many cases, CRS initiatives have found it easy to collect and use the necessary data, especially in disaster management situations. International law and cooperation are in this case very helpful as they favor and stimulate the unobstructed flow of information worldwide. *The Outer Space Treaty*[6] as well as the 1986 *United Nations Principles relating to remote sensing of the Earth from space* provide for the freedom of access to outer space and the freedom of remotely sensing the Earth and collecting information. They also call for international cooperation and dissemination of the information collected to all the sensed States which might benefit from it. This principle has

[6] United Nations Treaty on principles governing the activities of States in the exploration and use of outer space, including the Moon and other celestial bodies, 1967.

been taken on seriously by States with remote sensing capabilities, and many of them are taking part in the International Charter on Space and Major Disasters, which provides a unified system of space data acquisition and delivery to those affected by natural or man-made disasters. It is therefore thanks to governments and the United Nations that volunteers of the GISCorps had access to the most recent high resolution images of disaster-struck areas, like the earthquake in Japan.

Another important legal aspect at the data collection stage is privacy, meaning what kind of data can actually be collected and distributed. But here again the matter is complex. Regulations may or may not be in place depending on who is collecting and what they are observing.

Privacy is a complex notion. It has different meanings in different cultures and enjoys different levels of protection according to State law. There is a reference to the right to privacy in Article 12 of the 1948 *Universal Declaration on Human Rights*[7]. This declaration has no binding legal force but is now usually being recognized as having customary value. Moreover this principle has been repeated in the 1966 *International Covenant on Civil and Political Rights*, in its Article 17.

At the European level, Article 8 of the 1950 *European Convention on Human Rights*[8] also protects privacy but only against intrusions by public authority. To find more precise and detailed legislation, it is necessary to look at the national level, as each State is sovereign with respect to how it applies the right to privacy on its territory. In most countries, national legislation mostly protects against violations of privacy by public authorities, but no mention is made of private or commercial intrusions. These cases then need to be dealt with on a case-by-case basis, which does not offer an environment of legal certainty. Interestingly, cases such as privacy infringements by Google Street View have been dealt with differently in different European States. While Germany declared Google Street View as legal, Swiss courts ruled that Google must take action to protect privacy by blurring out faces and license plates numbers[9]. In some countries, the term "privacy" does not even translate directly and is not protected as a right as such.

In the specific area of remote sensing data, the issue of privacy is even more complex and less regulated, as technologies move faster than legislation. Not

[7] Article 12: "No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honor and reputation. Everyone has the right to the protection of the law against such interference or attacks."

[8] Article 8: "1. Everyone has the right to respect for his private and family life, his home and his correspondence. 2. There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others."

[9] Switzerland is not a member of the European Union but is a member of the Council of Europe, and as such has signed the European Convention on Human Rights.

even public authorities' use of satellite technology is clearly regulated yet, let alone commercial or private use. For example, a town in the United States has used Google Earth to spy on swimming pools constructed without permits to collect fines. After a lot of negative press, the local council has decided to stop this practice through satellite images, but there was no law in place to force it to do so. Another widely reported case is the ability of police or other public authorities to track the location of a person through a cell-phone, with the help of cellular phone service providers. Whether this should be allowed or not is much debated, as it can have many applications, both positive (finding a missing person in need of help or locating a criminal) and negative (helping an abusive husband or parent finding a person that tries to escape).

These privacy rights issues remain mostly unsolved and are dealt with on a case-by-case basis. They are only likely to increase with technology developments. Numerous lawsuits about privacy are currently on-going related to social networks and Google Street View, either coming from individuals or from governments. In March 2011, France fined Google for its collection of personal data and information through wireless networks. Real threats and perceived threats to privacy are different and the boundary is difficult to determine. It is likely that privacy would not be a major legal issue for most of the data that is being used in community remote sensing efforts but the laws, regulations and public feelings about it are so complex and diversified, that this uncertain situation might actually inhibit the use or collection of certain data.

For CRS projects, it is therefore best to rely on volunteer disclosure of data, instead of random collection of data on the web for example. Using text or photographs coming from social networks like Twitter or Facebook, should be an option, but it should always be done with the full awareness and consent of the individual user. With privacy being such an uncertain area of law, this consent will have to be dealt with carefully. A better legal and policy frame for privacy would therefore be particularly useful and would greatly improve efficiency and open up possibilities.

b. Data access and usage

Data collection depends on the possibility of access to the data needed. Ease of access depends:

- on the source (freely available, commercially available),
- on the customer (government, commercial, educational, private),
- on the purpose (disaster mitigation, climate change, business development, education, etc.).

For example, in Europe, most governmental science satellite data is freely available for science or educational purposes. But it has a cost if the purpose is business-related. Another aspect that was briefly discussed earlier is national security and the international circulation of data. It might, in some cases, be

easier to access data from ones own country, but this is mostly true for very high-resolution data, and still in most cases, images are circulated quite freely, although at some cost to the buyer.

As was said previously, in the case of a disaster, images will be provided freely and immediately to help recovery. So data access also depends on the purpose for which the data will be used.

So in general, access to existing data can be managed relatively effortlessly, especially with the Internet and extensive on-line databases.

Once accessed and collected however, it must be decided if it is actually safe to use the data. There are many legal restrictions on data usage that need to be researched and understood before using any kind of data. Even for data that is freely available, like Google Maps for example, a set of rules always has to be followed when re-using the data for another purpose.

Virtually everywhere, the person producing any kind of printed, written or in some way publicized image, data or text is protected by copyright, by default. This means that the person that created the data needs to receive at least proper attribution when the work is re-used. This is very well-known for books or music, but the same principle applies for remotely sensed data. Copyright is however not always the most appropriate way to protect remote sensing data, as it cannot cover raw data, which is not an original creation. Copyright can only protect original data, which means processed data in this case. Other forms of legal protection may however apply to raw data, like database protection[10], or ownership rights. Policies are usually in place for using remote sensing data, and in most cases a license needs to be acquired. The license details the conditions under which the data can be used, which can be more or less restrictive. A few typical conditions include:

- the data shall be used only for the particular purpose for which the license is granted,
- it shall not be used for any purpose that would be against the law,
- it shall not be altered,
- it shall not be further distributed.

These last two conditions are usually not compatible with community remote sensing projects, as the aim is usually to add information layers and then further distribute the new data.

[10] For example, Directive 96/9/EC of the European Parliament and of the Council on the legal protection of Databases was adopted in March 1996, and provides copyright protection for the intellectual creation involved in the selection and arrangement of materials; and *sui generis* protection for an investment (financial and in terms of human resources, effort and energy) in the obtaining, verification or presentation of the contents of a database.

This licensing system may often restrict usage of this kind of data by CRS initiatives, as their particular needs conflict with the terms of the license. Very often though, there is no particular licensing system in place, and this may result in even more confusion. It does not mean the data is not protected, it just means it is more difficult to know which type of usage is allowed or not.

Many organizations providing data free-of-charge such as Google, do have a policy and terms and conditions of use of their data. However, as each organization may have a slightly different policy, it becomes quite difficult to keep track of all of this in a CRS project, where there are many contributors and many layers of data. Therefore it is more prudent for a CRS project to ban the use of protected data, and only rely on original data created by the contributors or on data in the public domain. This drastically reduces the amount of data that can be used.

A good example of a project that has adopted this angle is Open Street Map. Open Street Map (OSM) is an open initiative to encourage the growth, development and distribution of free geospatial data and to provide geospatial data such as street maps for anybody to use and share [11]. In their copyright and license policy as well as in their legal dispositions, they forbid contributors to use maps coming from GoogleMaps and other protected data like it. To quote their Legal FAQ: “Only sources with compatible licenses - such as US Government information released into the public domain - may be used as base for adding OSM data. However, it is OK to use Yahoo! Aerial Imagery, as Yahoo! has agreed to allow OSM to use it. Better still, create the data yourself!”

This is a good example of how to avoid legal issues in a CRS project, but it also provides evidence that a legal system with a clear and uniform approach to licenses and overall with a better comprehension of the uses of technology could make such initiatives much easier to handle and also more efficient. The fact that a street map initiative cannot use GoogleMaps shows two things: inefficiency, as the same work will most probably be done in duplicate; and ineffective use of copyright, which only prompts citizens to make their own “free” version of GoogleMaps.

Overall it can be noted that there are two types of data most commonly used by CRS projects: governmental data freely accessible for disaster management or science, and data created directly by the contributors themselves specifically for the CRS project (such as photos, GPS points or text messages containing relevant information). These are the “safest” types of data, from a legal perspective.

c. Data distribution and sharing

[11] http://www.openstreetmap.org/

Once the data has been collected and used, the outcome of a CRS project is usually a new set of data, the purpose of which is then to be widely distributed and shared in the community.

If the data that was used as a source was protected by copyright or specific licenses, sharing and distributing it might be either forbidden or to be done under specific conditions (for example proper attribution to the owner of the copyrighted material used). Even if this was the intention at first, when the license or terms of use were accepted, it might prove difficult to comply with in the end. First, because of the variety of sources used to compile the new data, it might seem irrelevant or very complex to attribute one particular layer to one particular owner. Second because of the vast distribution network and the amount of contributors, it might be difficult to control that this attribution is always made and the legal terms always followed.

One complex question is the term “derived work” and what it covers. The problem is not only to apply the legal restrictions but to apply them correctly and knowing which restrictions actually apply. If only a very small part of the data is used to create a new set of data, should the licensing policy of this data apply to the whole compilation? What if this is the case for several of the pieces of information used and the licenses contradict themselves? As CRS is usually a compilation of many different data, it can be very complex to attribute a coherent legal status to the compilation.

The solution found by Open Street Map is therefore one of the safest ones. All the data used is in the public domain, or specifically created for the project – the contributors having previously agreed to the OSM terms – and the result (i.e. the compilation of data) is protected under a Creative Commons license. Creative Commons is a very interesting initiative, proposing a standardized way to grant copyright permissions, and is applicable worldwide[12]. To quote their website: “The combination of our tools and our users is a vast and growing digital commons, a pool of content that can be copied, distributed, edited, remixed, and built upon, all within the boundaries of copyright law”. Creators can choose from one of the six major standardized Creative Commons licenses, each with a different level of protection related to attribution, further sharing, derivative works and use for commercial purposes. For example, Open Street Map uses the “Attribution-ShareAlike license”. According to the Creative Commons website: “This license lets others remix, tweak, and build upon your work even for commercial purposes, as long as they credit you and license their new creations under the identical terms. This license is often compared to “copyleft” free and open source software licenses. All new works based on yours will carry the same license, so any derivatives will also allow commercial use. This is the license used by Wikipedia, and is recommended for materials that would benefit from incorporating content from Wikipedia and similarly licensed projects.”

[12] http://creativecommons.org/licenses/

Initiatives such as Creative Commons are very useful for CRS projects, as they answer their need for a standardized, internationally-applicable and legally acceptable way of distributing and sharing the data.

Creative Commons also offers a way for creators to abandon all copyright on their creations and let it enter the public domain, but only if this is allowed under their national law. It is important to know that in some legal systems opting out of copyright is not an option.

One final legal issue with the use and sharing of data compiled by CRS projects is liability. This is especially important with CRS as data quality and control is more difficult to monitor.
Liability in the case of CRS is directly linked to data quality. How can the quality and the accuracy of the data be trusted and can it/should it be verified? This is one of the limitations of CRS and of all participatory or "open" projects, like Wikipedia for example. By allowing volunteer participation and by opening up data to be modified and added upon by anyone, there is always a risk of inaccuracy. Since it is volunteer-based, there can be no real monitoring or guarantee of the content. Errors can be detected and modified, but there is no guarantee that they will be. Another example in the space field is GPS, which is a free service but has never been guaranteed by the US government. It is there for everyone to use, but at their own risk as the US government does not accept liability in cases of inaccuracy. Both GPS and Wikipedia are widely used and trusted, although not always rightfully. It is always best not to rely on these technologies exclusively and always confirm the information with other reliable sources (like a map or a real encyclopedia). Unfortunately this is not always done and may lead to embarrassing legal cases, where it is hard to define who is liable.

The question is, will this liability issue limit the use of CRS data or harm the development of this type of initiative? Whereas it is unlikely that it will harm the development of CRS, as open source projects keep flourishing in this digital age, the lack of guarantee of data quality might very well limit the uses made of CRS data for critical issues like disaster response or science model building. As noted before, using and sharing are the main purposes of CRS data, and limitations to them should be avoided. However each CRS project is also different in this aspect. If data can never be 100% guaranteed, there are levels of trustworthiness, depending on who the contributors are, how and if they are selected, how many people are involved and how the project is managed. Something as wide open as Wikipedia cannot be compared to the GISCorps project, where a small number of professional volunteers are carefully selected for each project and where one volunteer is a designated manager.

Two examples of cases in which uncertainty over data quality could harm the use of CRS data are political pressure and lawsuits. In the courtroom as well as in the political arena, the only acceptable arguments are ones that are verified,

verifiable or coming from reliable sources. Satellite images have been accepted in court for a few years now, but CRS data is a whole different matter. The same thing is true for convincing a local government to change its policy for example. Unreliable CRS data will hardly be a convincing argument, although one of the powers of the science coming from CRS information could and should be political.

Liability issues should be dealt with very carefully in the case of CRS. It would be counterproductive to force organizations involved with CRS to guarantee their data and to assume liability for them. This would probably be the certain death of most CRS projects. Another approach would be to standardize the use of liability disclaimers for CRS projects. This aspect goes hand-in-hand with the technical challenge of metadata requirements in CRS, and should probably be tackled simultaneously, through cooperation between technical and legal experts in the field.

This idea of a dialogue among all actors involved in CRS is crucial in finding the way forward for solving both technical and legal issues of community remote sensing.

3. Potential ways forward

Laws are sometimes uncertain and outdated and usually do not reflect the level that technology has reached and its applications. This is not surprising as laws are usually reactive and answer a need after a new situation arises. As was detailed above, legal consequences on CRS initiatives are both direct and indirect: direct when there is a law specifically limiting access or sharing of particular data (national security or intellectual property license); indirect when the laws are not clear or do not include this particular case, or when it is unclear which law should apply to a certain compilation of data. This might create unwillingness in sharing or using data.

There are several aspects of CRS legal issues that need to be tackled in the near future to create a safer environment for CRS, and several approaches may be used for this. First of all, communication and dialogue between the CRS and the legal communities should be favored to create understanding and raise awareness. There are different institutions and forums worldwide that can be used as discussion platforms, but the national level should not be overlooked as that is where the actual implementation will have to take place.

a. Standardization and Harmonization

One of the most pressing issues for CRS projects seem to be related to standardization and a common understanding of the rules and the technologies involved. Technical as well as legal aspects need to be standardized and these often go hand-in-hand. For example, one of the technical challenges of CRS is

how to manage all the data in a coherent manner so that it can be useful for the scientific and political community. With data managed coherently and standardized metadata, the liability fears will be reduced accordingly. This would create clearer categories of data and therefore make it easier to understand which data is fit for which particular purpose – a very important notion in liability.

The boundaries of privacy and data collection on the Internet are also directly related to technical evolutions. If there could be a general understanding of what is acceptable and what not in this field, it would drastically reduce the fear of lawsuits and increase efficiency. However this seems to be one of the hardest areas for harmonization because of the complexity and the cultural sensitivities of the matter. The way forward here will probably go through custom rather than through hard legislation. As people grow accustomed to new technologies, their views on the boundaries of privacy change. Overtime cultures change and in this technological age, cultures seem to change ever more quickly. It is unrealistic for a system of law to keep pace with these changes and it will probably evolve slowly as an adaptation to a fluid reality.

The area that could be standardized more realistically and with direct and concrete benefits would be data sharing and intellectual property. Without harmonizing intellectual property laws worldwide, there could be an effort made to raise awareness about community remote sensing and its goals, which are mainly scientific, educational and related to disaster management and other public goods. If specific licenses could be designed for this kind of project and on a global basis, use and sharing of the necessary data might be facilitated. As we saw with the Creative Commons initiative, there are already efforts made in this direction. Some individual companies and governments are also implementing enabling policies. This should be encouraged and globally harmonized if possible.

Overall any standardization process seems to be challenging, especially on a global basis. Most areas still remain in the realm of national sovereignty. Even in the European Union, it remains hard to harmonize, and even if there are basic principles that need to be respected in all European States, the implementation and the specifics can be different in each State. The benefits of harmonization are nonetheless numerous and all possible efforts should be made in this direction, both at the international and at the national level.

b. International and national efforts

Several international institutions already work on the different issues at stake, such as the World Intellectual Property Organization (WIPO), the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), the Group on Earth Observations (GEO) or the Committee on Earth Observation Satellites (CEOS). Maybe the harmonization and overall legal acceptance of usage of CRS

should be discussed by those institutions to try to achieve an international understanding.

As an example, CEOS is already making Earth Observation data more easily available, through their Data Democracy initiative. This initiative aims at providing "timely access to key data sets free of charge to build capacity worldwide, especially with respect to developing countries. Additional Data Democracy initiatives include enhanced data dissemination capabilities, sharing of software tools, increased training, and technology transfer to end users. CEOS Member agencies recognize that the GEOSS Data Sharing Principles should serve as the basis for data access in this context to contribute data for the public good. In particular, CEOS agencies will contribute to the GEOSS Data Core by making several datasets available on a full and open basis"[13].

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Another international effort that is taking place is within the CRS community itself, through international conferences and raising awareness. It is only by communicating about the new projects and the new challenges, that these can be met. Dialogue between the actors involved in CRS is the first essential step, and especially between the technical and the legal communities. It is by understanding the specific needs and challenges of CRS from a technical viewpoint and by comprehending the purpose of CRS, that legal systems can be adapted usefully and that practices can become more in line with legal requirements. This dialogue is already initiated in several international conferences and within institutions, and should be further encouraged, also on a smaller scale for small steps forward and concrete results.

On the national level, in order to incorporate technology leaps into the legal system and to cater for the specificities of CRS, help from the CRS and legal communities will be required to formulate definitions, broad categories and priorities. This should be based on the international efforts already taking place.

4. Conclusions

Community remote sensing is a recent development, based on technology improvement and citizen involvement. Legal systems worldwide are not yet fully prepared for these major changes that are not only related to technical capabilities but also to cultural changes. The problem with legal evolutions is that they take a long time, whereas the priority is to make CRS easy and efficient as quickly as possible. Therefore a bottoms-up approach would be the most feasible, realistic and efficient approach to legal change and harmonization. Usually the legal solution is given by usage. The CRS community, as well as all citizens and businesses involved in social networking and crowd-sourcing will probably show the way. After a few years of legal uncertainty and confusion, there is hope that a few broad and common principles for these issues will be

[13] Taken from the CEOS Rio Statement, available at: http://www.ceos.org/images/General/14Oct2010-CEOS-RIO-Statement.pdf - GEOSS stands for Global Earth Observation System of Systems

found and will be agreed upon internationally. These widely accepted principles will then be able to find their way into national and international systems.

NOTE: Nevertheless, there is a need to promulgate the legal issues involved with CRS and find ways to reduce liability.