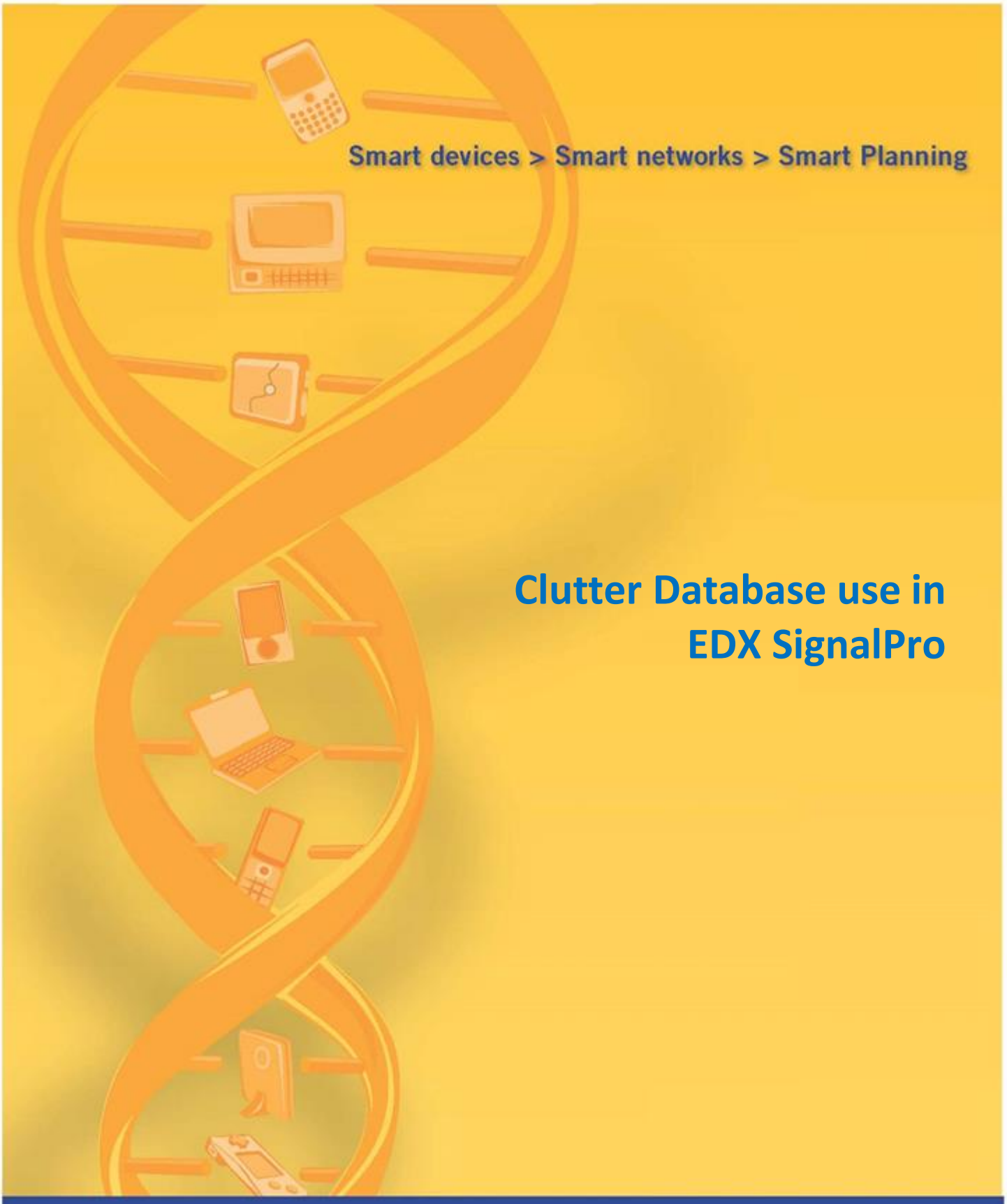

Smart devices > Smart networks > Smart Planning

Clutter Database use in EDX SignalPro

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EDX WIRELESS

Clutter Database use in EDX SignalPro

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Overview

Of critical importance in the design of any wireless network is the creation of a 3D model of the service area to account for physical characteristics that will affect propagation. Typically, these models are built using terrain elevation and land use (clutter) data (and in some cases; building data). And while terrain certainly has an effect on the propagation of radio signals, perhaps even more impactful is localized features of the environment such as structures and foliage. As wireless networks become more complex in ever changing service area environments, it is vital to use clutter data that will allow engineers to build the most accurate model possible. This paper will discuss the various considerations when choosing a clutter database.

Land Use (Clutter) Data

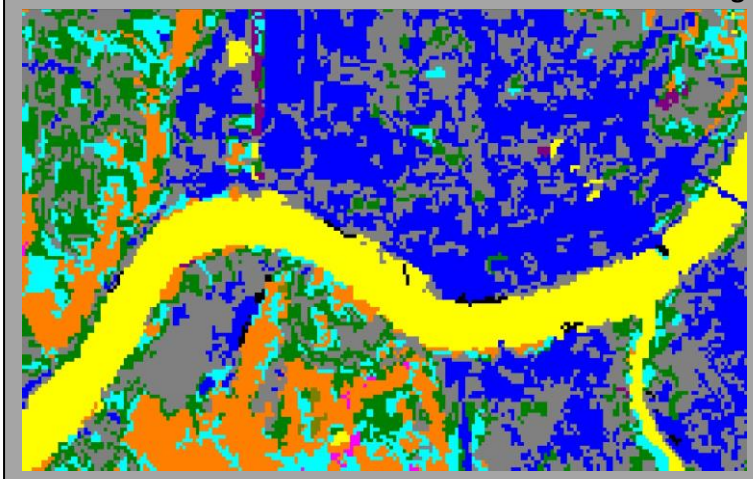
One commonly used source of clutter data is the National Land Cover Database (NLCD) produced by the USGS. However, in many cases, such as those in which system buildout will occur in a dense urban area, this data does not provide the resolution and accuracy needed to properly model a service area. Fortunately, EDX SignalPro supports a variety of databases and will accommodate custom databases at very high resolutions. While it is true that custom clutter databases can be costly depending on the size of the service area, resolution etc, one option to obtaining a high resolution database at a reasonable cost is to procure a hybrid database - such as those offered by EGS Technologies; http://www.egstech.com

Hybrid Clutter Data

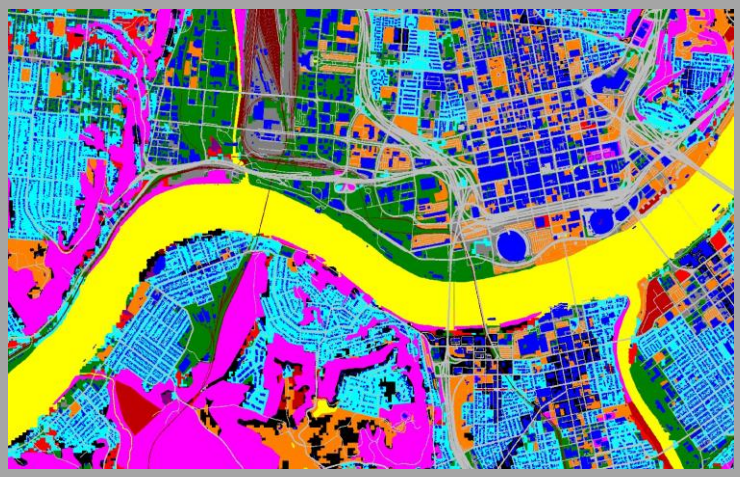
Consisting of multiple data sources, hybrid clutter offers accurate data with resolutions as high as one meter. Hybrid data is made up of imagery from different sources to provide the highest resolution possible in the areas where it is most applicable. For example; you would most likely see higher resolution data in dense, urban areas and lower resolution in rural type areas that are sparser in land use considerations and do not require a higher resolution database. With the cost of many high resolution databases difficult to justify, particularly when their benefit is limited to dense urban area, a hybrid database then becomes a very attractive option.

Figure 1 illustrates the difference between clutter data from 30m USGS 2011 release and 1m/30m Hybrid data over an area in Cincinnati, Ohio:

Figure 1



30m USGS Clutter Data



1m/30m Hybrid Data from EGS Technologies

This level of resolution becomes particularly important in AMI or small cell applications in which complex network architecture can be greatly affected by physical issues that manipulate the RF performance of the system. Because these higher resolution databases can show street canyons and often times individual building footprints, they also become useful for systems in which transmitters or mobile units are at a street level where roads, buildings and other obstructions need to be taken into account to properly model system coverage. That is not to say the benefit of these high resolution databases is limited to only a particular network type, as clearly, a high resolution database will provide a more accurate model and therefore produce a more accurate representation of coverage for any system type.

Additionally, resolution is not the only factor when considering various clutter databases. Also of great importance is the accuracy in which clutter is categorized - and thereby the proper attenuation values assigned to each area. A complete clutter database will include a clutter attenuation file, providing each clutter class name and correlating those clutter classes with an average height and attenuation that results from each class at varying frequencies. For example, an attenuation file may contain a category of 'Open Water' with little attenuation assigned to it, whereas a category of 'Developed High Intensity' would carry a much greater attenuation value. Knowing then that a service area may contain within it varying "category" considerations, it becomes clear how important it is to have a database that accurately classifies these and assigns the proper attenuation values. Consider Figures 2 and 3 below, which compares 30m USGS and 1m/30m Hybrid data over an area in Eugene, Oregon.

Figure 2

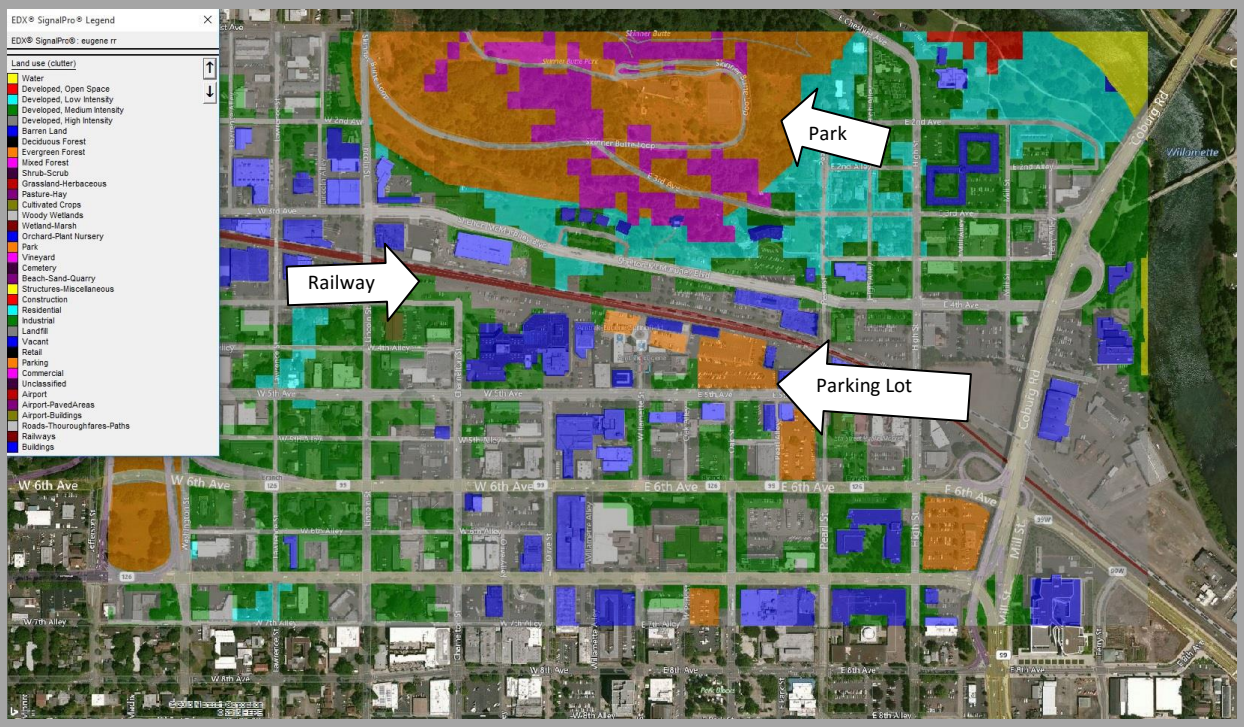
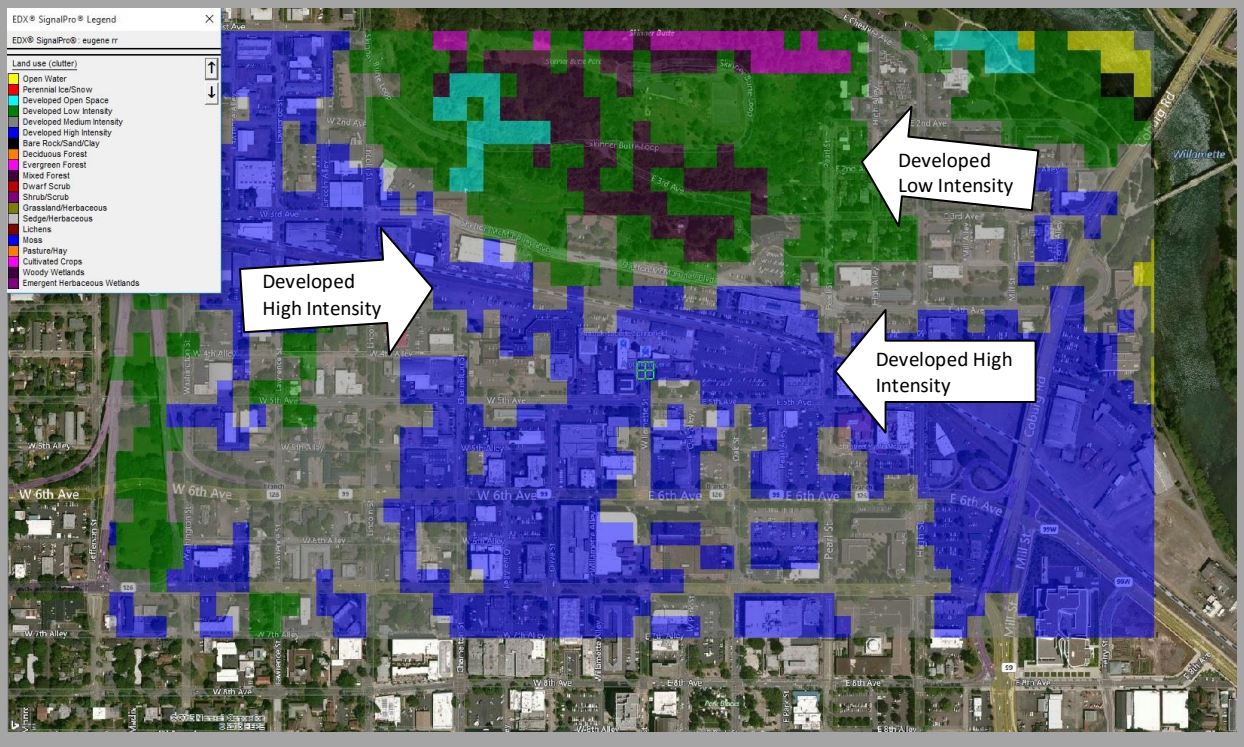


Figure 3

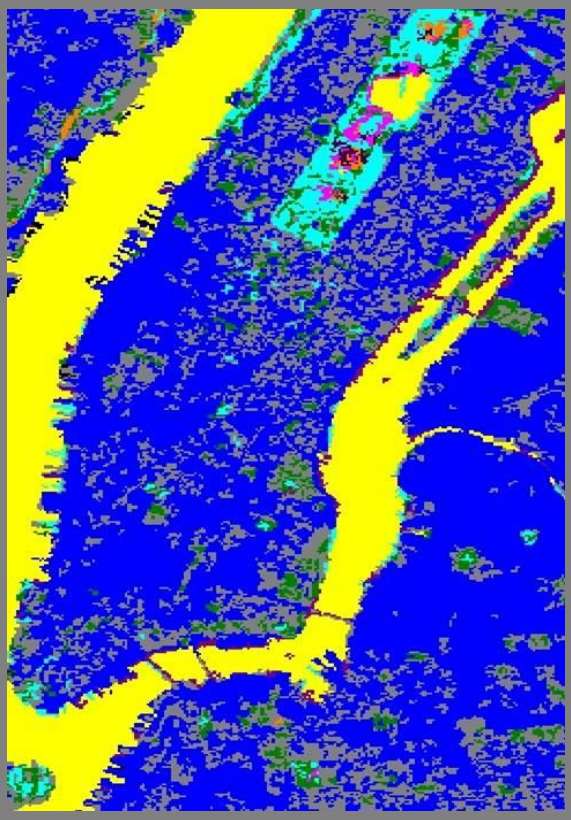


Aside from potential inaccuracies, it is also worth noting that USGS land cover data is used in many applications including; biodiversity conservation, water quality assessment and phenology of ecosystems[1] and as such, not all clutter categories assigned by the USGS are applicable in the planning of a wireless network. For use in a propagation model, the USGS clutter categories are typically mapped to an attenuation file that derives values from the TIA TSB-88 document with reclassification to the 20 categories deemed most relevant to RF planning as defined by this document. However, this often results in the combining of several categories, meaning blanket attenuation values applied to several land use areas. As an example; roads, parking lots and railways may be merged into the same category as seen in Figure 3 above. A custom database on the other hand, will contain clutter categories specific to RF planning considerations with an increased level of detail to the varying land use areas as seen in Figure 2 and appropriate attenuation values assigned as such.

Other custom clutter data

Although the focus of this particular paper has been on hybrid data as an alternative to USGS land cover data, there certainly are other options for custom databases. These databases come in varying resolutions and can be procured for individiual states, cities, counties or other service areas that cover any size region. Figure 4 illustrates an example of 15m clutter data from EGS Technologies as compared to 30m USGS data for a region over Manhattan, New York.

Figure 4

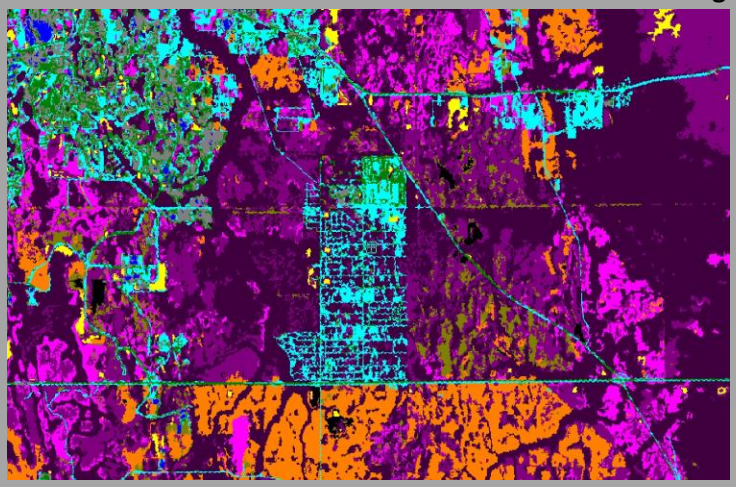


30m USGS Clutter Data

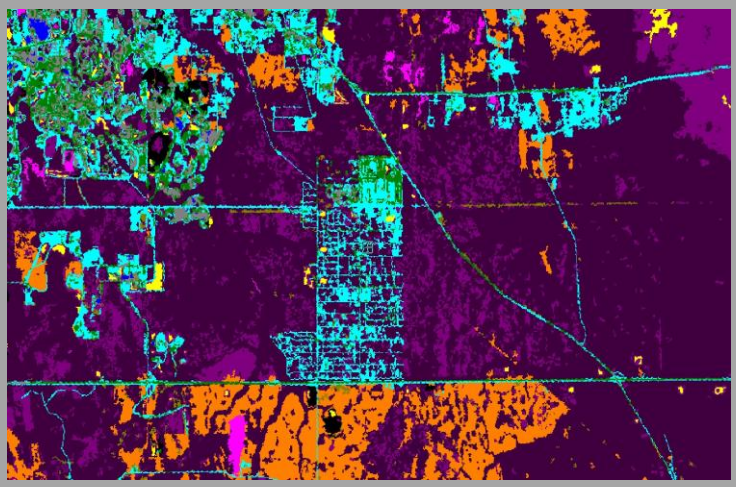
15m Clutter Data from EGS Technologies

These custom databases come from recent image acquisition sources, sometimes as recent as the current year, ensuring data that will accurately reflect area development. The most current release of the USGS data is from 2011, and while this release marked an improvement over the 2006 release (Figure 5 depicts the difference between 2006 and 2011 data over an area in Orlando, Florida), it does not necessarily reflect changes and expansions that have occurred in rapidly developing areas.

Figure 5



2011 USGS Clutter Data



2006 USGS Clutter Data

Custom databases are typically available for any location in the world and when purchased through EDX Wireless or from EGS Technologies, come in EDX's native format so no conversion is required by the user. Once imported into EDX SignalPro, these databases can be used, displayed and queried in a number of ways.

Conclusion

There are many clutter databases at varying resolutions that can be used depending on your service area, the type of model you are building and your specific network requirements. Given the complex nature of wireless networks and the ever-changing areas in which they service, it is crucial to build a proper model. A clutter database that is resolute, accurate and recent will ensure a model that takes into account the unique physical characteristics of a given service area and how those characteristics will affect any wireless network.

[1] http://landcover.usgs.gov/usgslandcover.php

