Table 17 Mangrove (% cover)

	DATA OPTION 1: Landsat ETM or SPOT XS	DATA OPTION 2: Radarsat, TerrsarX or ALOS Palsar	DATA OPTION 3: Quickbird 2
Spatial Dimensions			
Area to cover	185 km x 185 km per scene	Up to 3600 km ^{2}	12 km x 12 km per scene
Mapping unit	15 m panchromatic 30 m multi-spectral	5 m -60 m	068m panchromatic 4.0 m multi-spectral
Positional accuracy	Depends on level of Geo-referencing	Dependent on Geo-referencing process	Dependent on georef-erencing process
Temporal Dimensions			
When	Approx 9.45 am	Approx 11 am	Approx 10.45 am
How often	every 16 days	Minimum every 4 days	Minimum every 4 days
Variable to map	Mangrove cover (horizontal foliage projected cover)	Mangrove cover (horizontal foliage projected cover	Mangrove cover (horizontal foliage projected cover
Environmental / Sensor Restrictions	Cloud cover Mangrove fringe can be narrow, smaller then pixel size	Mangrove fringe can be narrow, smaller then pixel size Standing water on leaves of mangroves	. Cloud cover Mangrove fringe can be narrow, smaller then pixel size
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. ARCGIS Image Analyst)	PC Image processing software with radar image analysis capabilities, including sub-pixel mapping techniques.	PC Image processing software GIS with image classification module (e.g. ARCGIS Image Analyst)
Resource – Personnel	Trained in image classification Experience with	Trained in radar data processing. Knowledge of area to be	Trained in image classification Experience with high

	Landsat data Knowledge of area to be mapped	mapped	spatial resolution data Knowledge of area to be mapped
References: Note these are some example references	Liu et al (2008) Jensen (1991) Green et al (1998)	Lucas et al (2007) Simard et al (2006)	Held et al. (2003) - CASI Wang et al. (2004)

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Jensen, J. R., H. Lin, Y. Yang, E. Ramsey, B. A. Davis, and C. W. Thoemke. (1991). “The measurement of mangrove characteristics in Southwest Florida using SPOT multispectral data.” Geocarto International 2, 13–21.

Liu, K., Li, X., Shi, X., and Wang, S. (2008). “Monitoring mangrove forest changes using remote sensing and GIS data with decision-tree learning.” Wetlands 28: 336-346.

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Wang, L., W. Sousa, P. Gong, and G. Biging, (2004). “Comparison of IKONOS and QuickBird images for mapping mangrove species on the Caribbean coast of Panama.” Remote Sensing of Environment 91, 432-440.

Table 18 Mangroves (Extent)

	DATA OPTION 1: Landsat ETM	**DATA OPTION 2: Airborne hyper-spectral data**	**DATA OPTION 3: Quickbird 2**
Spatial Dimensions			
Area to cover	185 km x 185 km per scene	Up to 1000 km ^{2}	12 km x 12 km per scene
Mapping unit	15 m panchromatic 30 m multi-spectral	0.5m – 5m	068m panchromatic 4.0 m multi-spectral
Positional accuracy	Depends on level of Geo-referencing	Dependent on Geo-referencing process	Dependent on georef-erencing process
Temporal Dimensions			
When	Approx 9.45 am	User defined	Approx 10.45 am
How often	every 16 days	User defined (can be < 1 day)	Minimum every 4 days
Variable to map	Mangrove (species, cover, biomass)	Mangrove (species, cover, biomass)	Mangrove cover
Environmental / Sensor Restrictions	Cloud cover Mangrove fringe can be narrow, smaller then pixel size	Strong winds, Cloud cover	Cloud cover Mangrove fringe can be narrow, smaller then pixel size
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. ARCGIS Image Analyst)	PC Image processing software with Hyper-spectral analysis capabilities, including sub-pixel mapping techniques.	PC Image processing software GIS with image classification module (e.g. ARCGIS Image Analyst)
Resource – Personnel	Trained in image classification Experience with Landsat data Knowledge of area to be mapped	Trained in hyper-spectral data processing. Knowledge of area to be mapped	Trained in image classification Experience with high spatial resolution data Knowledge of area to be mapped
References:	Liu et al (2008)	Lucas et al (2007)	Held et al (2003)

Note these are some example references	Jensen (1991) Green et al (1998)	Simard et al (2006)	Wang et al (2004)

Green, E., C. Clark, P. Mumby, A. Edwards, and A. Ellis, (1998). “Remote sensing techniques for mangrove mapping.” International Journal of Remote Sensing 19, 935-956.

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Jensen, J. R., H. Lin, Y. Yang, E. Ramsey, B. A. Davis, and C. W. Thoemke. (1991). “The measurement of mangrove characteristics in Southwest Florida using SPOT multispectral data.” Geocarto International 2, 13–21.

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Wang, L., W. Sousa, P. Gong, and G. Biging, (2004). “Comparison of IKONOS and QuickBird images for mapping mangrove species on the Caribbean coast of Panama.” Remote Sensing of Environment 91, 432-440.

Table 19 Mangroves (Species)

	DATA OPTION 1: Landsat ETM	DATA OPTION 2: Airborne hyper-spectral data	DATA OPTION 3: Quickbird 2
Spatial Dimensions			
Area to cover	185 km x 185 km per scene	Up to 1000 km ^{2}	12 km x 12 km per scene
Mapping unit	15 m panchromatic 30 m multi-spectral	0.5m – 5m	068m panchromatic 4.0 m multi-spectral
Positional accuracy	Depends on level of Geo-referencing	Dependent on Geo-referencing process	Dependent on georef-erencing process
Temporal Dimensions			
When	Approx 9.45 am	User defined	Approx 10.45 am
How often	every 16 days	User defined (can be < 1 day)	Minimum every 4 days
Variable to map	Mangrove (species, cover, biomass)	Mangrove (species, cover, biomass)	Mangrove cover
Environmental / Sensor Restrictions	Cloud cover Mangrove fringe can be narrow, smaller then pixel size	Strong winds, Cloud cover	Cloud cover Mangrove fringe can be narrow, smaller then pixel size
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. ARCGIS Image Analyst)	PC Image processing software with Hyper-spectral analysis capabilities, including sub-pixel mapping techniques.	PC Image processing software GIS with image classification module (e.g. ARCGIS Image Analyst)
Resource – Personnel	Trained in image classification Experience with Landsat data Knowledge of area to	Trained in hyper-spectral data processing. Knowledge of area to be mapped	Trained in image classification Experience with high spatial resolution data Knowledge of area to be

	be mapped		mapped
References: Note these are some example references	Green et al (1998)	Lucas et al (2007) Held et al (2003)	Wang et al (2004) Kovacs et al (2005)

Green, E., C. Clark, P. Mumby, A. Edwards, and A. Ellis, (1998). “Remote sensing techniques for mangrove mapping.” International Journal of Remote Sensing 19, 935-956.

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Table 20 Mangroves (Biomass)

	DATA OPTION 1: Radarsat, TerrsarX or ALOS Palsar
Spatial Dimensions	
Area to cover	Up to 3600 km ^{2}
Mapping unit	5m -60mm
Positional accuracy	Dependent on Geo-referencing process
Temporal Dimensions	
When	Approx 11 am
How often	Minimum every 4 days
Variable to map	Mangrove cover (horizontal foliage projected cover
Environmental / Sensor Restrictions	Mangrove fringe can be narrow, smaller then pixel size Standing water on leaves of mangroves
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software with radar image analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in radar data processing. Knowledge of area to be mapped
References:	

Note these are some example references	Held et al (2003) Lucas et al (2007) Simard et al (2006)

Held, A., C. Ticehurst, L. Lymburner, and N. Williams, (2003). ”High resolution mapping of tropical mangrove ecosystems using hyperspectral and radar remote sensing.” International Journal of Remote Sensing 24, 2739-2759.

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