



Forest Industry Requirements for Biomass Measurements

Mondi's Perspective



Mondi at a Glance

- International vertically integrated forestry, pulp and paper company

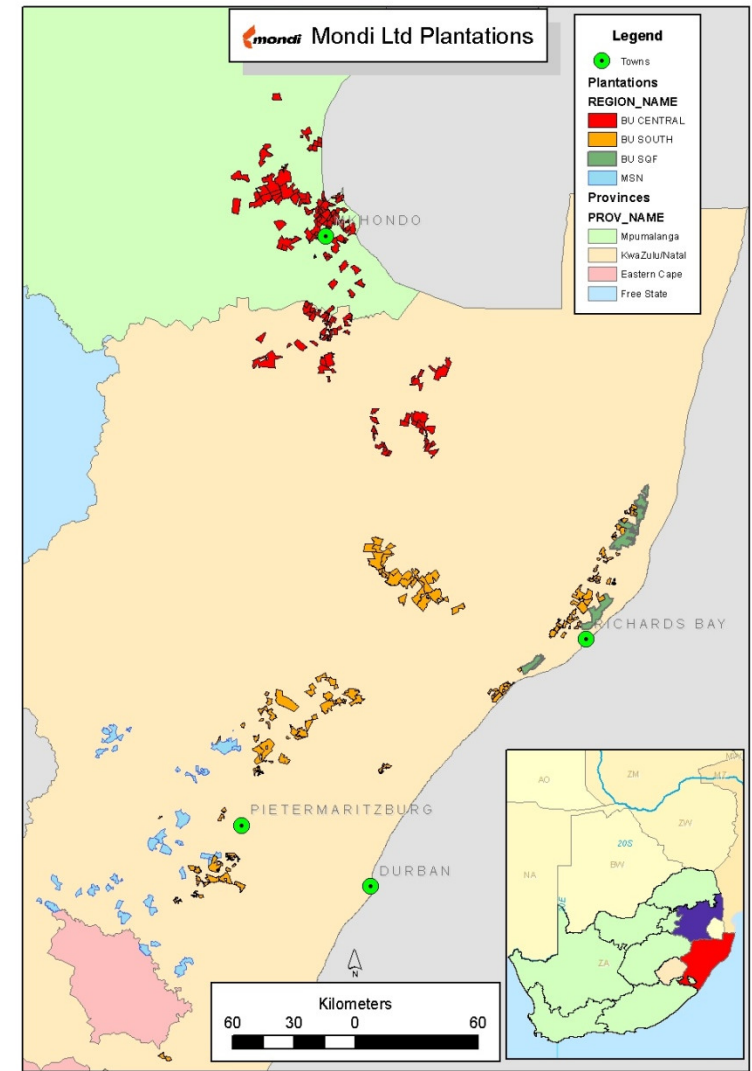
- **Mondi South Africa: Plantation Forestry**

- 301 000 ha: 6 areas in KZN and Mpumalanga
- 204 000 ha: Planted
 - Eucalyptus: 146 000 ha
 - Pine: 40 000ha
 - Wattle: 18 000 ha
- Ownership
 - Owned: 229 000 ha
 - Leased: 71 500 ha
 - Managed: 500 ha

- FSC Certified

- **Mondi Syktyvkar – Russia: Boreal Forestry**

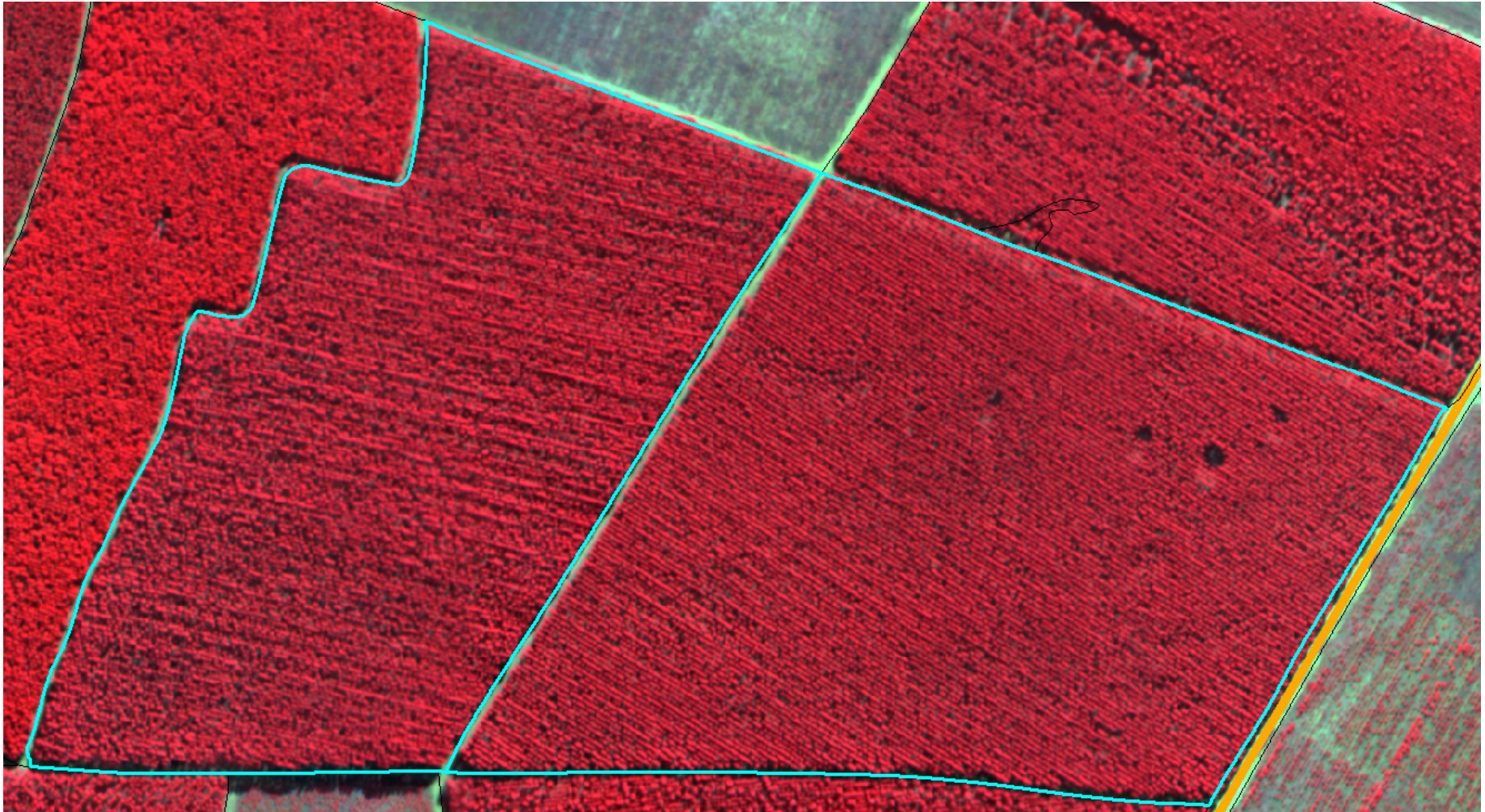
- Komi Republic
- Ownership
 - Owned: 0 ha
 - Leased: 2 100 000 ha
- FSC Certified



Current Uses of Remote Sensing Technologies

- Spatial Technologies (GIS/Remote Sensing) core to forest management
- Main Focus
 1. Map Land Base
 2. Classify Land Base
 3. Monitor Land Base and Actions on it
 4. Provide Management Information
- **Monitoring Process**
 - Annual Image Acquisition Programme - ~120 000 ha/yr (Aim: No imagery >2yrs old)
 - Various Image Processing techniques applied – Measure canopy cover/vigour
 - Every compartment within image is assessed; compared with PMi Data; classified
 - Categories: No Action; Potential Edit; Infield Check; Volume Reduction; Database Query
 - Each category has sub-classes,
 - e.g. Potential Edit – Boundary Edit; Split/Merge Compts;
 - Report supplied to relevant Data Editors for follow-up with Foresters.

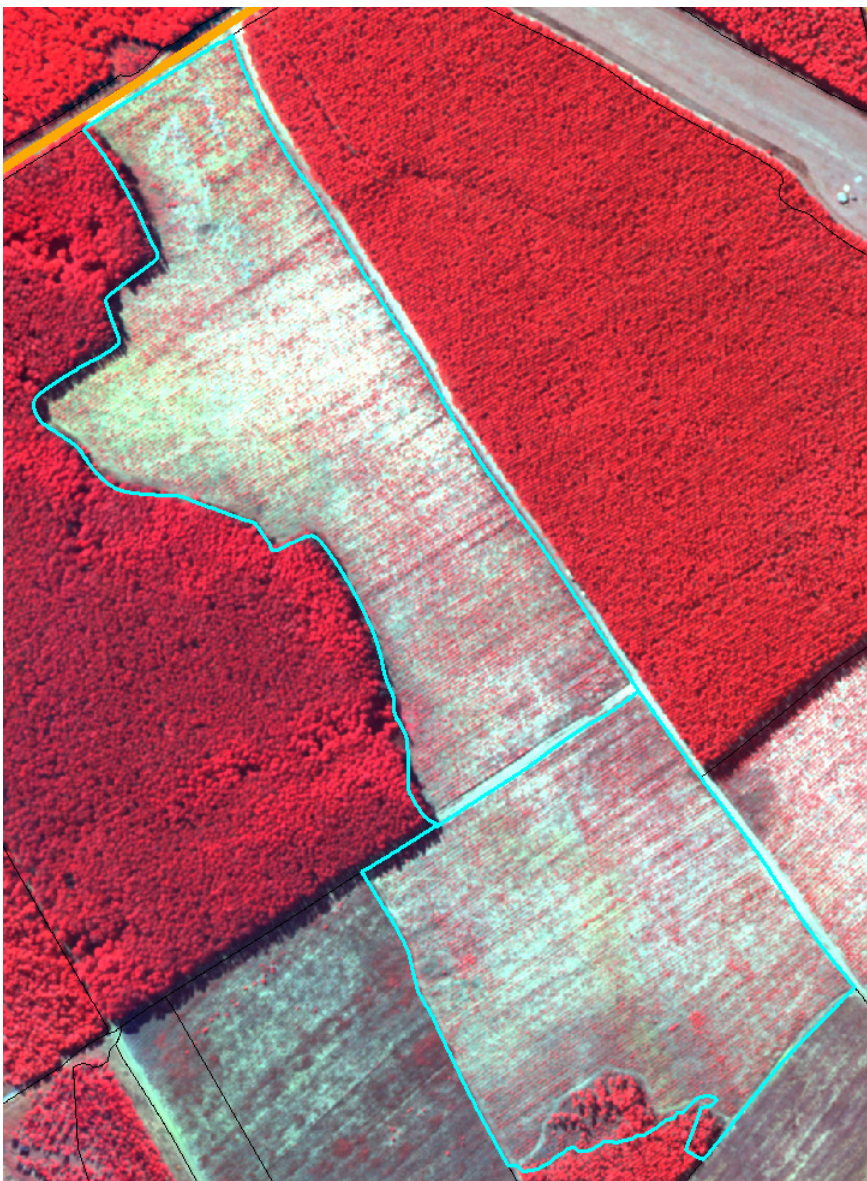
Example of No Action – Good Stocking



Example of Potential Edit – Boundary Edit



Example of Potential Edit – Merge Compts



- **In one Area:**
- 289 of 1700 Compts recommended to be merged (17%)
- Ave Compt Size = 11 ha
- If implemented, Reduce compts ~140
- Ave Compt Size = 23 ha
- Impact on mechanised harvesting/silvics

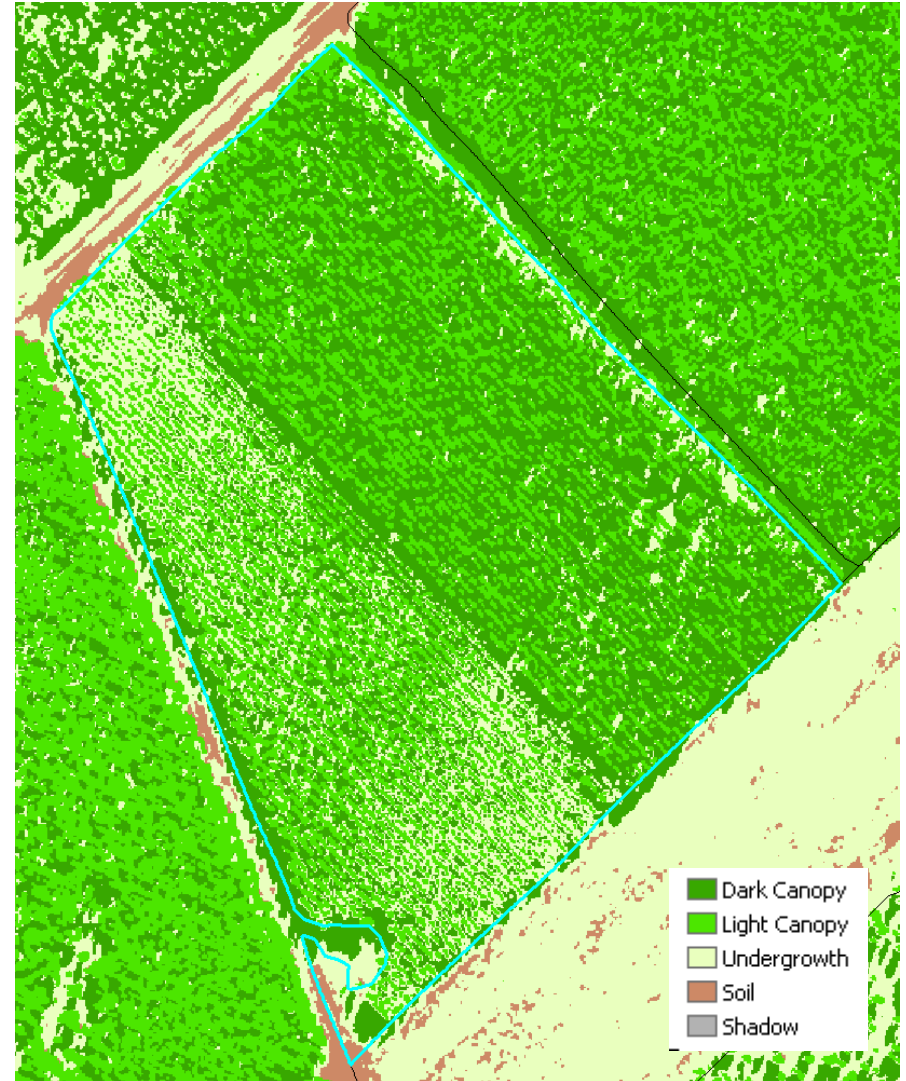
Example of Potential Edit – Split Compt



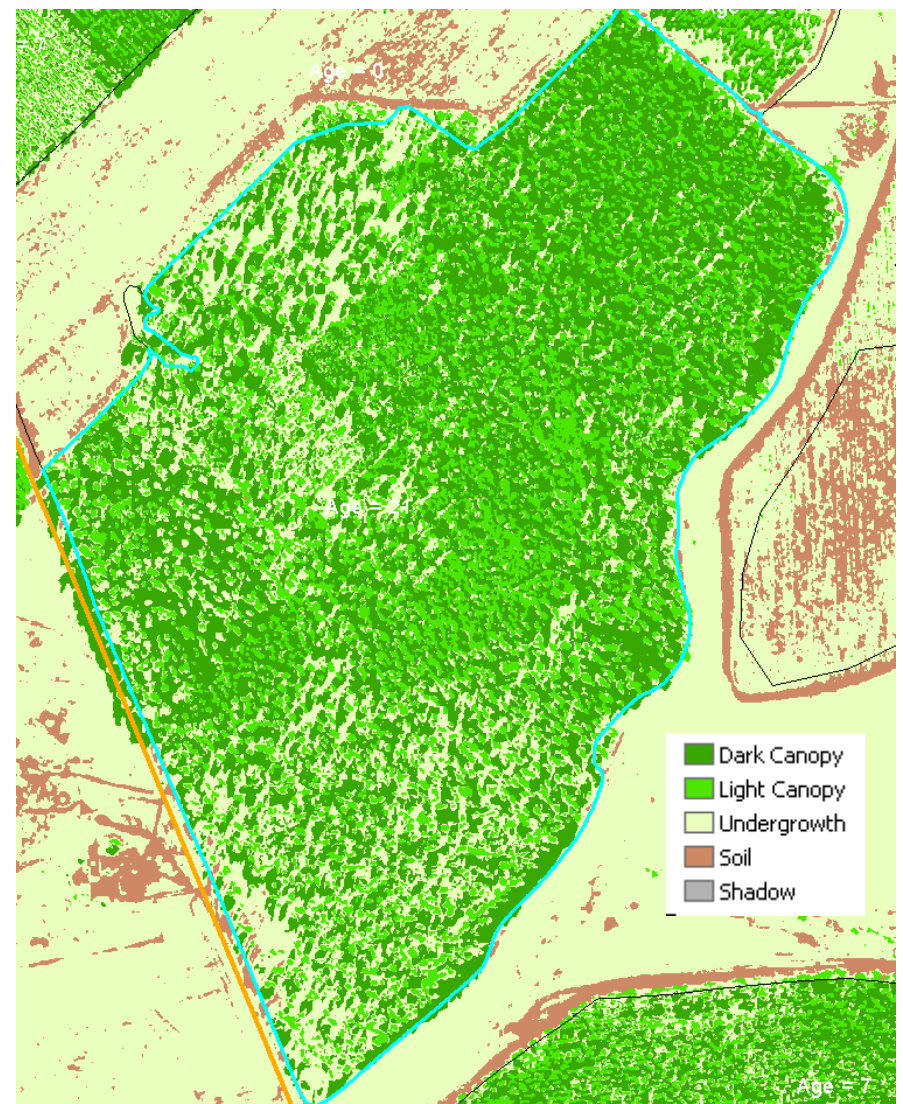
Example of Database Query: Incorrect Age



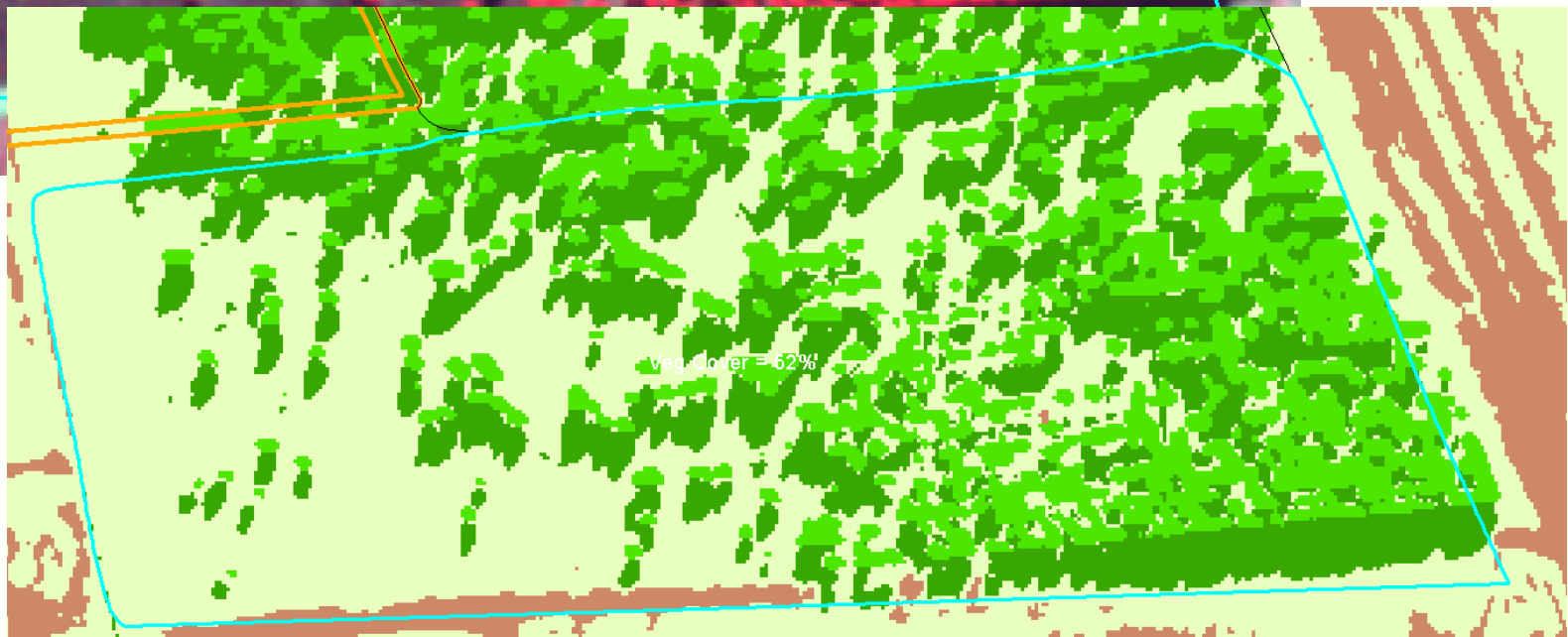
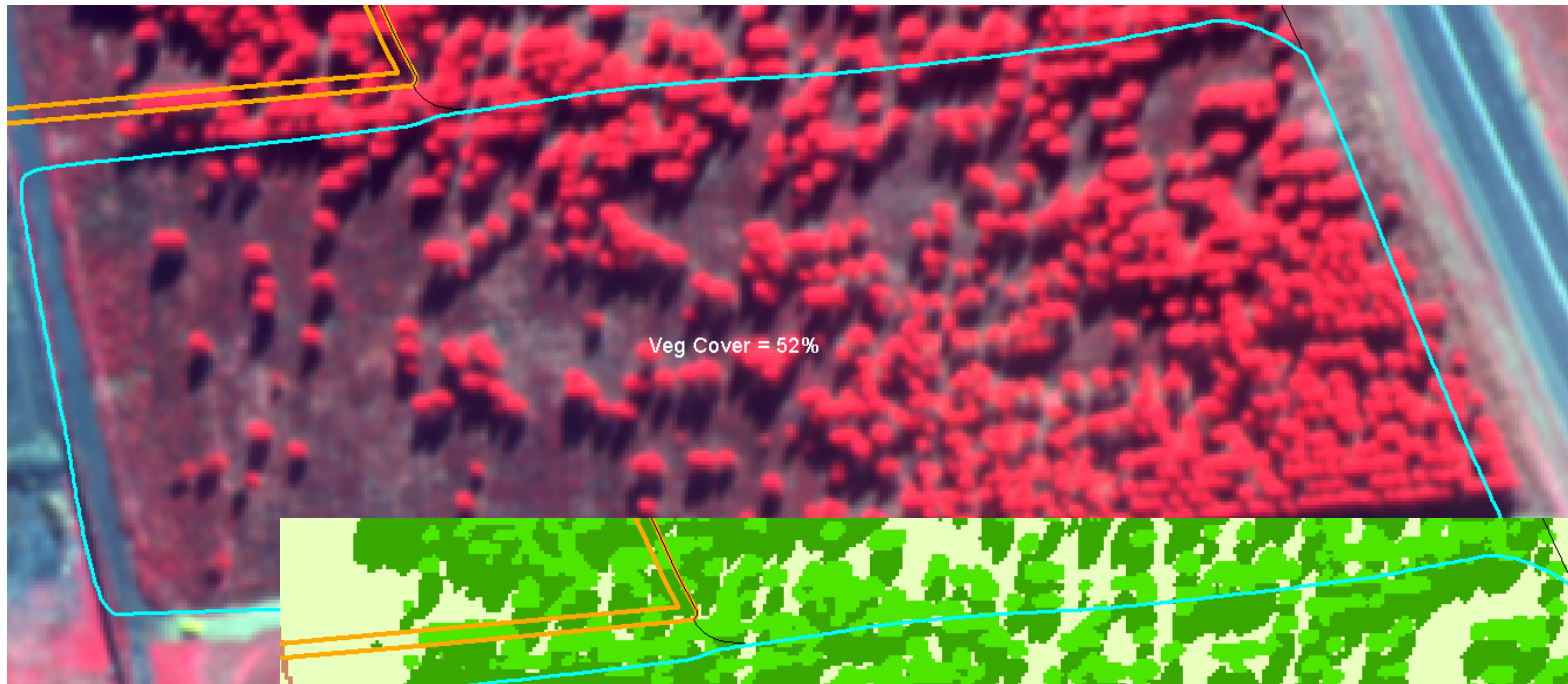
Example of Infield Check: Species/Ages



Example of Infield Check: Check Status Infield



Example of Volume Reduction: <60% Stocking



- Dark Canopy
- Light Canopy
- Undergrowth
- Soil
- Shadow

Stand Assessment: Drought Damage



Example of Tabular Report: Compt. Assessment



SUB_COMP	SUB_C	CLASS1_PC	CLASS2_PC	CLASS3_PC	CLASS4_PC	RATING	VEG_COVER	ACTION	COMPT_STAT	WC	SP	FELLAUTHOR	PLDATE_NUM	AGE	TUPAGE_MON	ENUMDATE_N	ETPH	COPPICEYC	FELLDATE_N
R019	27.6	8	32	54	7	0.46	40	Volume Reduction	<80% Stocking	PP	PPAT	Mngt	200711	5	0	0	0	0	20240701
R020	7.2	12	9	75	4	0.1	21	Potential Edit	Merge Compartment	PP	PELL	Mngt	200503	7	0	0	0	0	20200701
R020A	8	23	43	30	3	0.77	66	Potential Edit	Merge Compartment	PP	PELL	Mngt	200503	7	0	0	0	0	20200701
R021	15.1	0	0	46	54	0	0	No Action	Young Stand <= 2yr	PP	PELL	Mngt	200912	2	0	0	0	0	20290702
R021A	0.9	0	0	80	20	0	0	Potential Edit	Merge Compartment	PP	PELL	Mngt	201104	1	0	0	0	0	20320701
R023	10	0	0	91	9	0	0	No Action	Pine Stand <= 3yr	PP	PELL	Mngt	200911	3	0	0	0	0	20280701
R024	11.5	17	4	74	5	0.04	21	Volume Reduction	<80% Stocking	PP	PELL	Mngt	200505	7	0	0	0	0	20210702
R026	2	4	23	66	8	0.29	27	Volume Reduction	<80% Stocking	GP	GDUN	Mngt	200802	4	0	0	0	0	20120702
R026A	4.9	18	36	38	7	0.57	54	Potential Edit	Merge Compartment	PP	PELL	Mngt	200503	7	0	0	0	0	20200701
R027	11.3	37	31	31	1	0.45	68	Potential Edit	Merge Compartment	PP	PELL	Mngt	200503	7	0	0	0	0	20200701
R028	7.5	0	0	59	41	0	0	In-Field Check	Check status infield	GP	GGRANIT	Mngt	0	0	21	0	0	0	0
R029	0.9	0	2	78	19	0.02	2	In-Field Check	Check status infield	GP	GGRANIT	Mngt	0	0	41	0	0	0	0
R029A	0.8	5	61	28	6	1.56	66	In-Field Check	Check status infield	GP	GGRANIT	Mngt	0	0	41	0	0	0	0
R030	1.5	0	13	79	8	0.15	13	Volume Reduction	<60% Stocking	GP	GDUN	Mngt	200802	4	0	0	0	0	20120601
R031	7.8	1	7	50	42	0.08	8	In-Field Check	Check status infield	GP	GGRANIT	Mngt	201010	2	0	0	0	1	20120702
R034	7.3	8	72	12	7	2.67	80	No Action	Mature Stand or Good Stocking	GP	GDUN	Mngt	200911	3	0	0	0	0	20190702
R034A	9.4	1	38	51	10	0.61	39	Potential Edit	Compt Boundary Edit	GP	GDUN	Mngt	201110	1	0	0	0	1	20220702
R035	5.6	18	37	39	6	0.59	55	Volume Reduction	<80% Stocking	GP	GGRANIT	Mngt	200701	5	0	0	0	1	20160702
R036	10.9	22	65	13	1	1.81	87	Volume Reduction	<80% Stocking	GP	GGRANIT	Mngt	200902	3	0	0	0	1	20180702
R037	2.6	28	71	1	0	2.45	99	Potential Edit	Merge Compartment	GP	GDUN	Mngt	200806	4	0	0	0	1	20170702
R037A	1.3	30	56	12	2	1.27	86	Potential Edit	Merge Compartment	GP	GBEN	Mngt	201010	2	0	0	0	0	20200701
R037B	4.9	25	72	3	0	2.57	97	Potential Edit	Merge Compartment	GP	GDUN	Mngt	200806	4	0	0	0	1	20170702
R038	6.4	9	74	14	3	2.85	83	Potential Edit	Merge Compartment	GP	GBEN	Mngt	201010	2	0	0	0	0	20200701
R039	8.8	35	53	12	1	1.1	88	Potential Edit	Merge Compartment	GP	GGRANIT	Mngt	200612	6	0	0	0	1	20160702
R039A	6.7	35	57	8	0	1.33	92	Potential Edit	Merge Compartment	GP	GGRANIT	Mngt	200604	6	0	0	0	1	20150702
R040	17.5	30	43	25	2	0.75	73	No Action	Mature Stand or Good Stocking	GP	GMAC	Mngt	200510	7	0	0	0	0	20150702
R042	15.6	63	27	9	1	0.37	90	Potential Edit	Merge Compartment	GP	GMAC	Mngt	200503	7	0	0	0	0	20140702
R043	7.7	54	34	11	0	0.52	88	Potential Edit	Merge Compartment	GP	GMAC	Mngt	200510	7	0	0	0	2	20150702
R044	1	30	30	34	6	0.43	60	Potential Edit	Compt Boundary Edit	GP	GMAC	Mngt	200502	7	0	0	0	0	20140702
R045	37.6	8	16	72	5	0.19	24	No Action	Young Stand <= 2yr	GP	GBEN	Mngt	201011	2	0	0	0	0	20210702
R046	14.4	7	10	66	18	0.11	17	No Action	Young Stand <= 2yr	GP	GBEN	Mngt	201003	2	0	0	0	0	20200702
R047	18.7	16	6	76	3	0.06	22	In-Field Check	Weed control?	PP	PELL	Mngt	200712	4	0	0	0	0	20240701



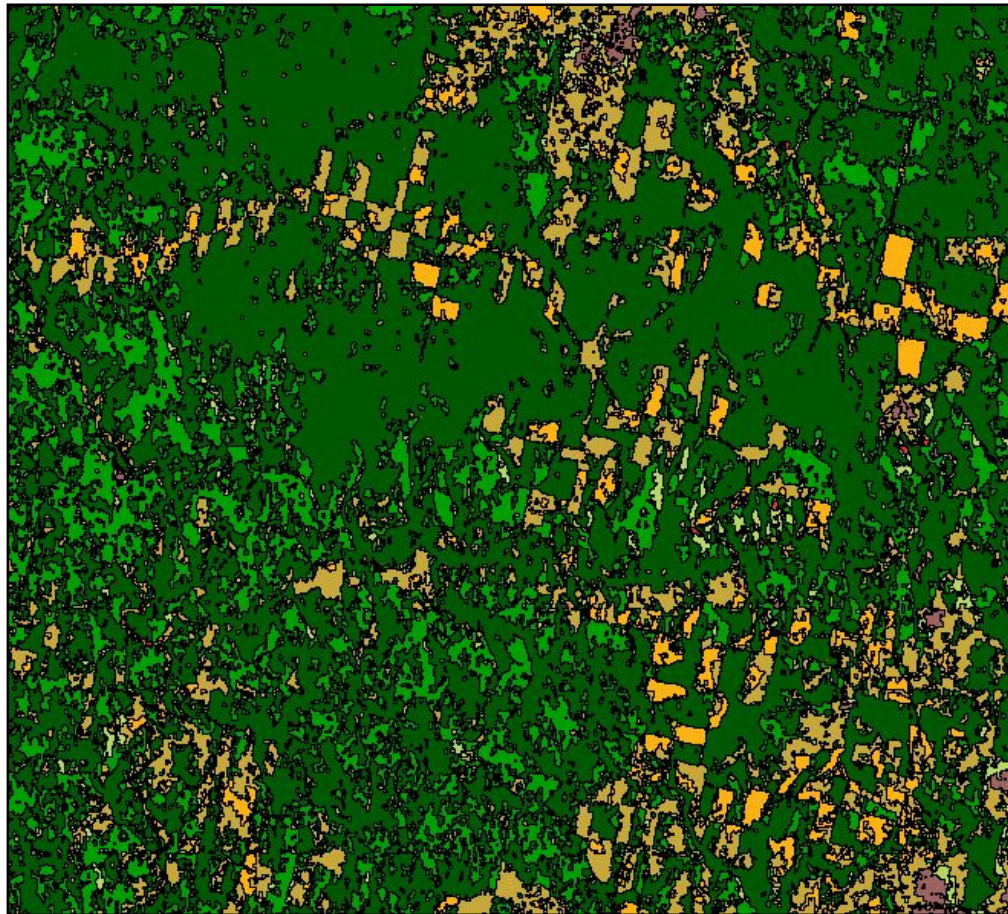
Mondi Syktyvkar trials Komi Republic - Russia

Mega forests

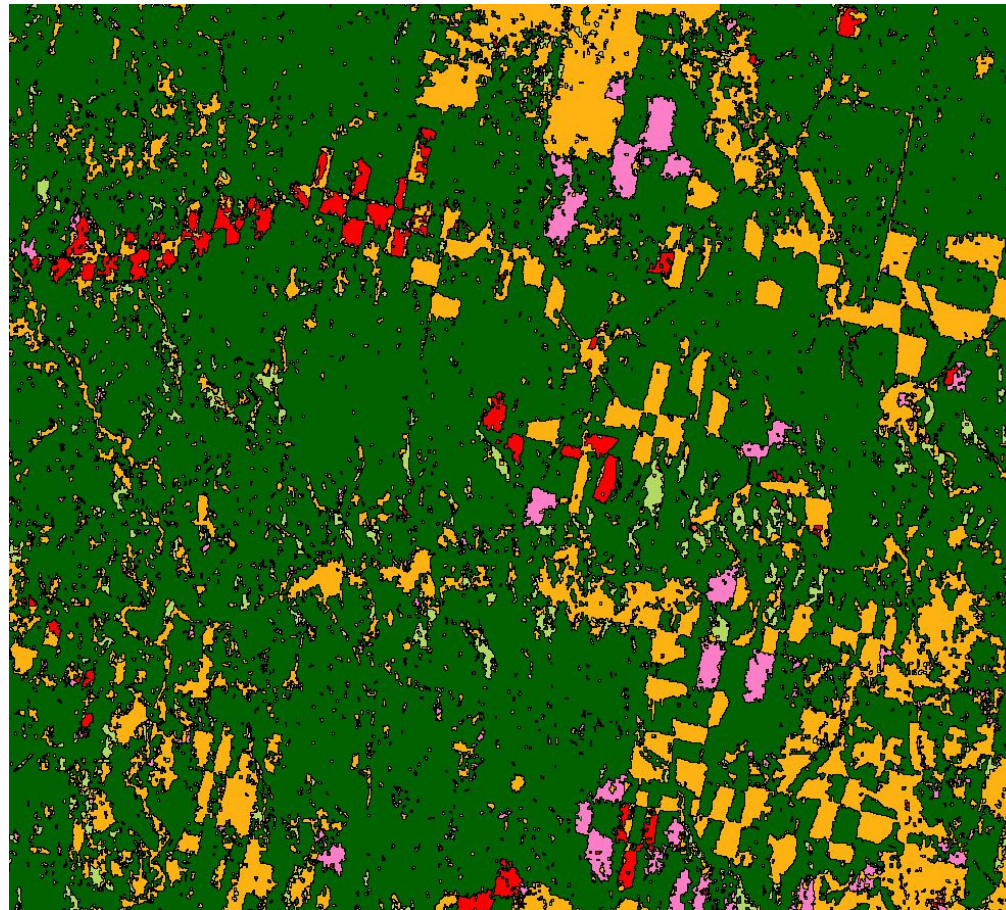
Natural Boreal (Spruce, Pine, Birch, Aspen)

See <http://www.fsc.org/esa.html> for full report

Forest area including land cover in non-forest areas



Forest area changes



before 2007

2007 - 2008

2008 - 2009

Forest Industry Requirements - Mondi



- **Build on Current Uses of Remote Sensing Technologies**

- Add Quantitative element to current Qualitative element
- Continued Focus
- 1. Map Land Base
 2. Classify Land Base
 3. Monitor Land Base and Actions on it
 4. Provide Management Information

- **Desired Uses of Remote Sensing Technologies**

- Quantitative Measurements
 - Forest Stand structural characteristics
 - DBH; Dominant Ht; Trees/ha; Basal Area
 - Stand Volume
 - Use of LiDAR Applications for these products
- Monitoring
 - Forest status – pest & diseases; fire; vigour
 - Monitor trends over time
 - Certification Purposes

Monitoring Strategic Plan



Spatial Scale	Temporal Scale	Methodology	Purpose
Regional e.g. Zululand Coast; Mkondo; Dumbe etc.	Biannual (twice yearly – Summer; Winter)	Satellite Imagery (5m RapidEye; SPOT)	Pest/Disease outbreaks; Other anomalies
WPU/Area	Biennial (Every two years) Continuation of current programme	Airborne Multispectral Imagery (0.75m LRI)	Remapping; Stand & Stocking Assessments; Pest/Diseases; Enumerations
Compartment	On-demand (Areas requiring more detailed surveys as identified above)	UAV technology	Pest/Diseases; Enumerations; Re-establishment Stocking Assessments;



Forest Industry Requirements - Mondi



- **E.O. Monitoring for Certification Purposes**
 - Need to reduce cost/complexities for Small Growers to be certified
 - Monitor Risk elements identified by Certification Principles & Criteria.
 - Measure impact of forestry on ecosystem services, e.g. water production
 - Measure illegal activities – planting; logging
 - Measure Carbon Stocks

- **Landscape-level Monitoring**
 - Need for more holistic approach – “get bigger picture”
 - Monitor on landscape level
 - Identify risk elements applicable to each landscape
 - Set thresholds on risk elements that trigger compliance monitoring
 - Allow for focused monitoring – Reduce costs



Acknowledgements: ESA/University of Jena - for travel sponsorship

Thank you

FORWARD - LOOKING STATEMENTS

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