

# Index

## A

- Activity data, 38
- Agriculture, Forestry, and Other Land-Use (AFOLU) Guidelines, 48
- Allometric models, 170

## B

- Biomass expansion factors (BEFs), 129
- Bottom-up approach
  - field selection, 29
  - field typology
    - definition, 30–31
    - field type scores, 29, 30
    - food security and poverty, 30
    - human-induced changes, 30
    - inherent land quality, 29
    - land management practices, diversity of, 31
  - landscape plots, 32
  - lower Nyando site, 30
  - replicated field sites selection, 32

## C

- Chamber measurements
  - auxiliary measurements, 91–92
  - dynamic chambers, 82–83
  - environmental conditions, changes in, 83–85
  - GC, 89
  - spatial variability, 85–86
  - spectroscopic methods, 90–91
  - static chamber, 83, 89

- Climate Change, Agriculture, and Food Security (CCAFS), 20
- Climate smart agricultural (CSA) practices, 164
- Cool Farm Tool, 5, 182
- Crop cards method, 169, 172
- Crop-cut method, 165, 171
- Crop modelling, 169, 172
- Cumulative mass coordinate approach, 144

## D

- Data (dis)aggregation techniques, 182
- Dendrochronology, 130
- Diameter at breast height (DBH), 121, 123, 126, 127

## E

- Elemental combustion technique, 143
- Emission factors, 38
- Empirical models
  - activity data, 180
  - advantage, 182
  - cumulative balance, 180
  - data collection, 182
  - emission factors, 180
  - higher levels organizations and large spatial extent, 181
  - IPCC Guidelines, 180–181
  - poorly constrained emission factors, 182
- Enteric methane production (EMP), 98
- Equivalent soil mass approach, 144
- EX-Ante Carbon Balance Tool (EX-ACT), 5, 182

**F**

- Farmers' estimation method, 172
- Fermentation processes, 98
- Field typology
  - definition, 30–31
  - food security and poverty, 30
  - human-induced changes, 30
  - inherent land quality, 29
  - land management practices, diversity of, 31
- Flame ionization detector (FID), 90

**G**

- Gas chromatography (GC), 89
- Gas pooling technique, 86
- Geographic information systems (GIS), 41
- Gestalt-theory, 19
- Greenfeed®, 110
- Greenhouse gas (GHG) emission
  - biosphere–atmosphere exchange processes, 72, 82–86
    - chamber measurements (*see* Chamber measurements)
    - micrometeorological measurements, 74–82
- CH<sub>4</sub>, 72
- CO<sub>2</sub>, soils, 72
- empirical models
  - activity data, 180
  - advantage, 182
  - cumulative balance, 180
  - data collection, 182
  - emission factors, 180
  - higher levels organizations and large spatial extent, 181
  - IPCC Guidelines, 180–181
  - poorly constrained emission factors, 182
- environmental conditions changes, 73
- field irrigation and water logging, 73
- flux measurements, 74
- intensity, 2
- measurement guidelines
  - adaptation and livelihoods, benefits of, 7
  - Cool Farm Tool, 5
  - current information, uncertainty of, 7
  - data acquisition, 3, 9
  - emissions estimation, 9–10
  - EX-ACT, 5
  - field measurement, 2
  - heterogeneous landscapes, 2–3
  - list of practices, 7
  - livelihood and food security improvement, 3
  - mitigation analysis, 9–10

- mitigation potential, 7
- NARS, 5
- national and subnational mitigation plans, 5
- national GHG inventories, compilers of, 5
- PCR, 5
- potential practices identification, 6
- question definition, 8
- resource limitations, 3
- SAMPLES website, 5
- students and instructors, 5
- Tier 1 emission factors, 2
- microbial processes, 72
- N<sub>2</sub>O emissions, 72
- process-based models, 182–185
- quantification of, 164
- recarbonization, 72
- rice paddies
  - methane, 86
  - rice chamber design and general procedure, 87–88
  - sampling frequency, 89
  - sampling, timing of, 88
  - upland systems, 87
- scaling methods, 177–179
- soil–atmosphere exchange processes, 72
- temperature changes, 72
- whole-farm and landscape level, 176

**I**

- IMPACTlite tool, 30
- Infrared thermography, 112
- Intergovernmental Panel on Climate Change (IPCC)
  - AFOLU Guidelines, 48
  - approaches, 39–41
  - carbon pools, 57
  - Tier 1, 39, 180–181
  - Tier 2, 39
  - Tier 3, 39
- Intraruminal telemetry, 112
- ISODATA algorithm, 29

**L**

- Land-use and land-cover (LULC) classification
  - activity data, 38
  - baseline scenario, 52–56
  - boundaries, 25
  - carbon stock changes calculation
    - individual/combined carbon pools, 57
    - initial carbon stock estimation, 57–58

- key carbon pools, 57
    - process-based method, 59
    - stock-based method, 59
  - carbon storing land, 38
  - category definition, 47–48
  - change detection
    - accuracy assessment, 62
    - activity data, 51
    - spatially explicit methods, 51–52
  - classification accuracy assessment, 60–62
  - data acquisition
    - existing datasets, 42
    - ground-based field sampling methods, 42–43
    - remote sensing data, 44–43
    - spatial considerations, 44–46
    - temporal considerations, 46–47
  - DEM, 25
  - direct measurement methods, 63
  - emerging technologies, 63
  - emission factors, 38
  - feature extraction, 24
  - GHG emissions/removals calculation, 38
  - image segmentation, 21
  - IPCC Guidelines, 38–41
  - landscape units identification, 19
  - non-spatially explicit methods, 49
  - Nyando, 25
  - object limits, 25
  - object-based approaches, 20, 25
  - reference regions, 56–57
  - RF, 25
  - RGB composite, 25
  - setting project boundaries, 41–42
  - spatially explicit methods, 49
  - stratification, 49–51
  - supervised classification, 50–51
  - transitions monitoring, 38
  - uncertainty, 59, 62–63
  - unsupervised classification, 50
  - visual interpretation, 50
- Low-Emission Development Strategies (LEDS), 5
- M**
- Methane emissions, 86, 87
- blood methane concentration, 111–112
  - direct measurement
    - open-circuit respiration chambers, 99–101
    - open-path lasers, 108–110
    - polytunnels, 101–107
    - sulfur hexafluoride tracer technique, 107–108
    - ventilated hood system, 101
  - indirect estimation
    - diet, 99
    - in vitro incubation, 98–99
  - infrared thermography, 112
  - intraruminal telemetry, 112
  - principles, 98
  - quantitative molecular biology, 112
  - short-term measurement
    - CH<sub>4</sub>:CO<sub>2</sub> ratio, 111
    - Greenfeed®, 110
    - PAC, 110–111
    - spot measurements, 111
- Micrometeorological measurements, 74–82
- Minimum information unit (MIU), 44
- Minimum mapping unit (MMU), 44
- Mitigation, smallholder agriculture, 29–31
- analysis, 16
  - bottom-up approach
    - (*see* Bottom-up approach)
  - climate implications, 16
  - field types, 17
  - GIS, 17
  - implementation, 17
  - initial steps, 17–18
  - land productivity, 17
  - landscape unit, 16
  - RS, 17
  - systematic selection, 16
  - top-down approach (*see* Top-down approach)
  - typology, 17
- Monitor, report, and verify (MRV), 5
- N**
- National agricultural research centers (NARS), 5
- National Forest Inventories (NFIs), 120
- Nationally Appropriate Mitigation Actions (NAMAs), 4, 5
- Normalized Difference Vegetation Index (NDVI), 26, 44
- O**
- Open-path lasers method, 108–110
- Out-of-bag (OOB), 25
- P**
- Photoacoustic spectroscopy (PAS), 90
- Polytunnels, 101–107

Portable accumulation chambers (PAC),  
110–111

Process-based models, 59, 149, 182–185

Product Category Rules (PCRs), 5

## Q

Quantitative molecular biology, 112

## R

Random forest (RF), 25

Random sampling approach, 43, 125

Recarbonization, 72

Reducing Emissions from Deforestation and  
Forest Degradation (REDD+), 40

Remote sensing, 170

## S

Scaling methods, 130, 177–179

Smallholder production system

allometric models, 170

crop cards method, 169, 172

crop-cut method, 165, 171

crop production estimation, 164–170

crop yield estimation, 166

expert assessment, 168–169

farmers' estimation method, 165–166, 172

harvest unit, sampling for, 168

remote sensing, 170

whole plot harvest method, 167–168, 172

Soil bulk density (SBD), 142, 144

Soil organic carbon (SOC) stock quantification

accuracy, 136–139

biotic factors and management activities, 136

comparative analysis, 136

cumulative mass coordinate approach, 144

equivalent soil mass approach, 144

sample collection, 142

sample preparation and analytical  
methods, 143

sampling design

farm level, 139

geographic/ecological boundary, 139

landscape level, 140–142

SBD, 144

scaling

average calculation, 145

field's surface area, 146

standard error, 146

uncertainty, 146

variance, 145

soil density rings, 145

spatial coordinate approach, 143

stock changes

coupling erosion processes, 150

dynamics, 150

frequency monitoring, 151–152

in situ analyses, 147

laboratory-based analyses, 147

monitoring, 147

process-based models, 149

recommendations, 151–152

remote spectroscopy, 149

stable conditions assumption, 150

Soil organic matter (SOM), 135

Spatial coordinate approach, 143

Spatially stratified systematic sampling  
approaches, 141

Spectroscopic methods, 90–91

Stock-based method, 59

Sulfur hexafluoride (SF<sub>6</sub>) technique,  
107–108

## T

Targeted sampling, 43

Top-down approach

carbon credit project, 18–19

field topology, 31

Gestalt-theory, 19

landscape boundaries, 19

landscape characterization and spatial  
configuration, 19

landscape plots, 32

landscape stratification, 20

CGIAR Program, 20

landscape classification, 25–29

LULC (*see* Land-use and land-cover  
(LULC) classification)

visual classification, VHR imagery, 20

mitigation potential, 18

Panoramio/Confluence Project, 19

replicated field sites selection, 32

Trade-off analysis

in agriculture, 190

definition, 190

econometric tools, 193, 194

empirical analyses, 193, 194

hypothesis, 190

integrated approach, 194

nature of, 191

optimization approaches, 193

participatory methods, 193

simulation models, 193–194

strengths and weaknesses, 194

tiered approach, 194–196

Tree biomass carbon stocks and fluxes  
  quantification  
  accuracy, 121  
  annual changes, 129–130  
  average time, 128  
  biomass assessments, 120  
  climate change, 120  
  cost, 122–124  
  direct methods, 123  
  indirect methods, 123, 124  
  NFIs, 120  
  plots selection, 125  
  proxies measurements,  
    125–128  
  scale, 122  
  TOF, 120  
  tree management, 121  
  typical precision, 119  
  whole-farms and landscapes, 130  
Tree outside forests (TOF), 120

**V**

Verified Carbon Standard (VCS), 40  
Very high-resolution (VHR) satellite images  
  LULC  
    boundaries, 25  
    DEM, 25  
    feature extraction, 24  
    image segmentation, 21  
    Nyando, 25  
    object limits, 25  
    object-based approaches, 20, 25  
    RF, 25  
    RGB composite, 25  
    visual classification, 20  
Voluntary Carbon Standard (VCS)  
  methodologies, 56

**W**

Whole plot harvest method, 167–168, 172