//define the region we are processing

var rectangle = ee.Geometry.Rectangle([-85, -56,-32, 18],'EPSG:4326',false)

Map.addLayer(rectangle)

//Mask information to exclude those bad observations

var getQABits = function(image, start, end, newName) {

var pattern = 0;

for (var i = start; i <= end; i++) {

pattern += Math.pow(2, i);

}

return image.select([0], [newName])

.bitwiseAnd(pattern)

.rightShift(start);

};

var filterBadObs = function(image){

var cloudQA = getQABits(image.select('StateQA'),0,1,'cloud')

var cloudShadowQA = getQABits(image.select('StateQA'),2,2,'cloud\_shadow')

var aerosolQualityQA = getQABits(image.select('StateQA'),6,7,'aerosol')

var cirrusQA = getQABits(image.select('StateQA'),8,9,'cirrus')

var internalCloudQA = getQABits(image.select('StateQA'),10,10,'internalCloud')

var snow = getQABits(image.select('StateQA'),15,15,'snow')

var blue = image.select('sur\_refl\_b03').lt(2000)

var maskedImage = ee.Image(0).where(

cloudShadowQA.eq(0)

.and(cloudQA.eq(0).or(cloudQA.eq(3)))

.and(aerosolQualityQA.eq(0).or(aerosolQualityQA.eq(1)).or(aerosolQualityQA.eq(2)))

.and(cirrusQA.eq(0).or(cirrusQA.eq(1)).or(cirrusQA.eq(2)))

.and(internalCloudQA.eq(0))

.and(snow.eq(0))

.and(blue.eq(1)),1);

return image.mask(maskedImage)

.copyProperties(image,image.propertyNames())

}

//Function to calculate VIs

var vegetationindex=function(img){

var lswi=img.normalizedDifference(['sur\_refl\_b02','sur\_refl\_b06']);

var evi=img.expression(

'2.5 \* (nir - red) / (nir + 6 \* red - 7.5 \* blue + 10000)',

{

red: img.select('sur\_refl\_b01'),

nir: img.select('sur\_refl\_b02'),

blue: img.select('sur\_refl\_b03')

}

);

return img.select([])

.addBands([lswi,evi])

.select([0,1],['lswi','evi'])

}

var goodObservation=function(img){

var lswi = img.select('lswi');

var goodObs = ee.Image(0);

var mask = goodObs.where(lswi.gte(-1),1)

return mask;

}

var evergreen=function(img){

var lswi = img.select('lswi');

var evi = img.select('evi');

var evergreenForest = ee.Image(0);

var mask = evergreenForest.where(lswi.gte(0).and(evi.gte(0.2)),1);

return mask;

};

//////////////////Main program start here////////////////////

var year = 2022

var col = ee.ImageCollection("MODIS/006/MOD09A1")

.filterDate(year+'-01-01',year+'-12-31')

.filterBounds(rectangle);

print('MOD09A1 collection',col)

var finalCollection = col.map(filterBadObs)

var newcollection = finalCollection.map(vegetationindex);

var goodObservationCollection = newcollection.map(goodObservation)

var frequencyGoodObservation = goodObservationCollection.sum();

var evergreenForest = newcollection.map(evergreen)

var frequencyLSWIGT0 = evergreenForest.sum();

var percentageEvergreen = frequencyLSWIGT0.divide(frequencyGoodObservation);

var minLSWI = newcollection.select('lswi').min()

var binaryEvergreen = (percentageEvergreen.eq(1.0)).or((percentageEvergreen.gte(0.9).and(percentageEvergreen.lt(1.0))).and(minLSWI.gte(0)))

var palette = ['FFFFFF', 'CE7E45', 'DF923D', 'F1B555', 'FCD163', '99B718',

'74A901', '66A000', '529400', '3E8601', '207401', '056201',

'004C00', '023B01', '012E01', '011D01', '011301'];

Map.addLayer(binaryEvergreen.clip(rectangle),{palette:palette,min:0,max:1}, 'binaryEvergreen')